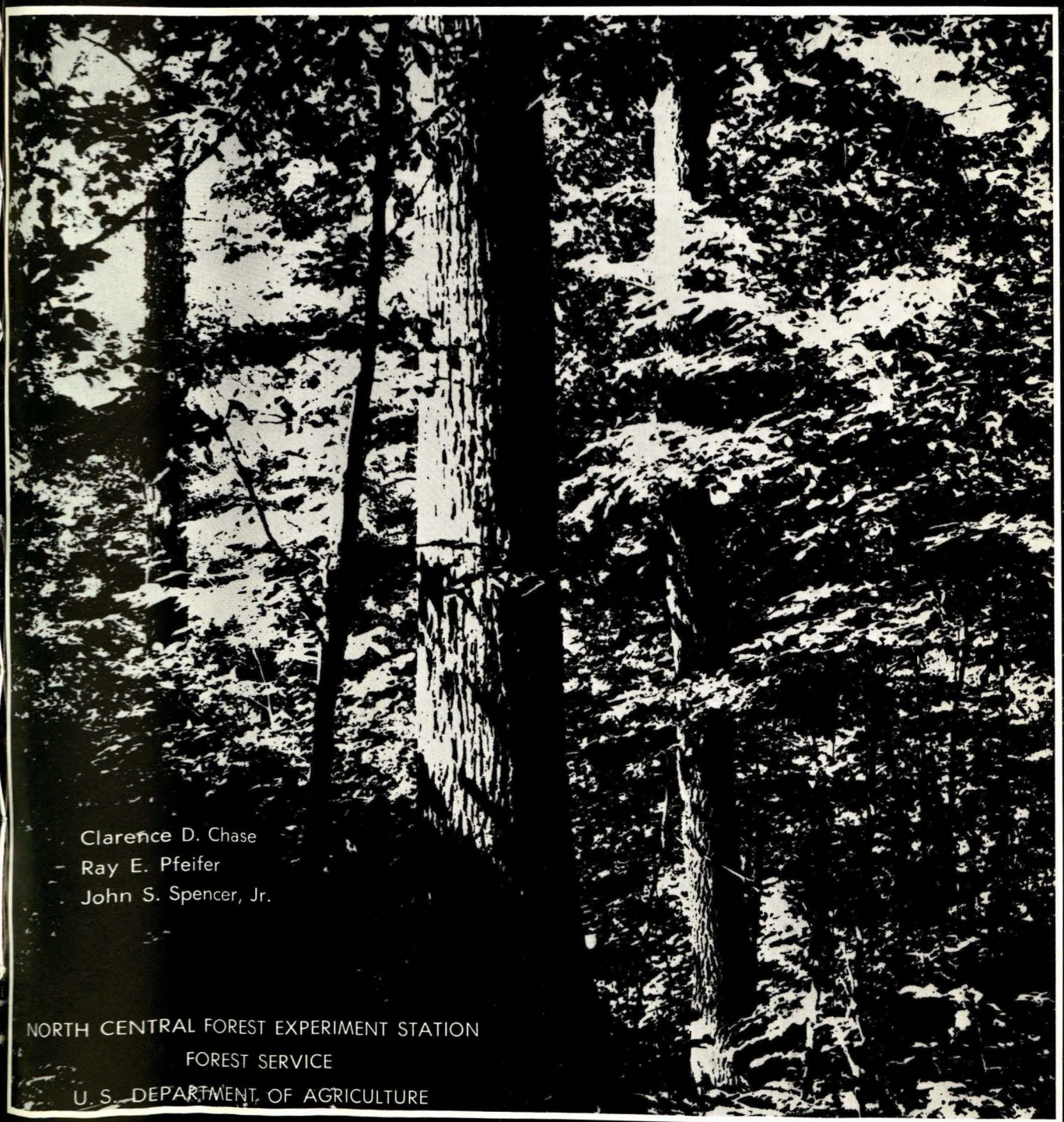
U.S.D.A. FOREST SERVICE
RESOURCE BULLETIN NC-9
1970

the Growing Timber Resource of Michigan 1966



Clarence D. Chase
Ray E. Pfeifer
John S. Spencer, Jr.

NORTH CENTRAL FOREST EXPERIMENT STATION
FOREST SERVICE
U.S. DEPARTMENT OF AGRICULTURE

FOREWORD

This report presents Michigan's timber resource in 1966 as found by the third Forest Survey of Michigan. It provides forest area, timber inventory, growth, mortality, removals, and forest industry statistics. It compares some of the findings with those of two previous surveys, 1935 and 1955.

The third Michigan Forest Survey was part of the continuing program authorized by Congress in the McSweeney-McNary Forest Research Act of 1928 to maintain a current inventory of the Nation's timber supply. The survey was organized and conducted by the North Central Forest Experiment Station, although all work was done under broad guidelines of the Forest Survey Steering Committee, a group composed of many public and private foresters within the State. A cooperative survey, the Michigan Department of Natural Resources provided substantial financial aid to obtain more accurate and localized statistics, provided timber resource data for the State Forests, and assisted in a canvass of timber use in the State. Through the Upper Peninsula Committee on Area Progress, funds were obtained from the Area Redevelopment Administration (later the Economic Development Administration) to purchase recent aerial photographs of most of the Upper Peninsula. The Eastern Region of the U.S.D.A. Forest service provided timber resource data for the four National Forests in Michigan. The State Office of the Agricultural Stabilization and Conservation Service provided aerial photographs for the Lower Peninsula. Appreciation is expressed to all those who participated in this forest resource investigation.

North Central Forest Experiment Station
D. B. King, Director
Forest Service – U. S. Department of Agriculture
Folwell Avenue
St. Paul, Minnesota 55101

CONTENTS

	Page
The Forest	1
Timber Use	12
The Future	17
Appendix	22

THE AUTHORS are, respectively, Principal Resource Analyst (retired), North Central Forest Experiment Station; Staff Forester, Michigan Department of Natural Resources; and Resource Analyst, North Central Forest Experiment Station. The Station is maintained in cooperation with the University of Minnesota.

HIGHLIGHTS

Timber Volume

- Growing-stock volume on commercial forest land in 1966 was 15.0 billion cubic feet, a 40-percent increase from the 10.7 billion cubic feet in 1955.
- The volume in sawtimber trees was 33.9 billion board feet in 1966, compared with 23.8 billion board feet in 1955.
- The average volume per acre of growing stock jumped from 7 cords in 1955 to 10 cords in 1966.
- Sawtimber stands averaged 1,240 board feet per acre in 1955 and rose to 1,790 board feet per acre in 1966.
- Hardwoods account for almost three-fourths of the growing-stock volume. Aspen and hard maple are the chief species.
- Two-thirds of the timber volume is in private ownership.
- In addition to the volume in sound, live (growing-stock) trees, there were 1,173 million cubic feet of sound wood in rough and rotten trees and 57 million cubic feet of sound wood in salvable dead trees.

Stand Conditions

- Net annual growth on growing stock was 580 million cubic feet in 1965, 18 percent greater than in 1954.
- The net annual growth rate averaged 3.9 percent of the inventory of growing stock.
- Mortality of growing stock was 244 million cubic feet in 1965, largely affecting quaking aspen, balsam fir, elm, and bigtooth aspen.
- Half of the State's timber stands are less than 40 years old.
- Although 51 percent of the commercial area is well stocked with growing-stock trees, "desirable" tree stocking is sparse.
- Fifteen percent of the commercial forest is more open than tree-covered (less than 50 percent stocked).

Forest Area

- Commercial forests, which represent 52 percent of Michigan's land area, included 18.9 million acres in 1966, a slight decline from the 19.1 million acres in 1955.
- Poletimber stands constitute 43 percent of the State's commercial forest, more than any other stand-size class.
- The maple-beech-birch type (5.2 million acres) and the aspen-birch type (4.7 million acres) constituted the largest share of the commercial forest.

Timber Use

- Growing-stock removals in 1965 amounted to 206 million cubic feet, 16 percent more than in 1954.
- Michigan's allowable annual cut from growing stock between 1966 and 1975 is estimated to be 380 million cubic feet.
- Sawtimber removals in 1965 were 823 million board feet, less than the allowable annual cut of 910 million board feet.
- Pulpwood made up more than half the volume of growing-stock removals.
- Between 1954 and 1965 the number of primary wood-using plants in Michigan decreased from 2,100 to 437, yet roundwood consumption rose about 12 million cubic feet.
- Removals of growing stock in 1996 are projected to be double those in 1966. Growth on growing stock is projected to remain above timber removals during this period, resulting in a larger inventory in 1996 than in 1966.
- Projected sawtimber removals, growth, and inventory are similar to those of growing stock.

the Growing Timber Resource of Michigan 1966

Clarence D. Chase, Ray E. Pfeifer, and John S. Spencer, Jr.

THE FOREST

Timber volume in Michigan has increased since the first survey in 1935 despite a slight decline in commercial forest area. About half of Michigan's land area is forested, boasting a total of 15 billion cubic feet of sound, live (growing-stock) trees. This increase in volume has come about largely because growth has remained greater than timber removals. Many of the seedling-sapling stands that dominated the 1955 forest have grown into poletimber stands—the most extensive stand-size class in 1966.

What forces molded Michigan's forest into their present shape? There were an estimated 35.5 million acres of forest land in what is now the State of Michigan when the earliest trappers and explorers arrived. This original forest contained about 10 million acres of prime pine and 9 million acres of high-quality northern hardwoods. The heavy cutting that followed the shift of logging activity from the eastern United States to the Lake States leveled much of the forest, and repeated fires destroyed much of what was left. Timber from this early logging provided a substantial amount of the products needed for building a rapidly expanding Midwest. Some of the cutover forest was cleared by settlers. By 1935 Michigan's once-magnificent forest had been reduced to about 19 million acres, nearly half of which was nonstocked or in the postfire aspen-brush type.

The pendulum was set in motion toward an improving forest situation in the 1920's when an effective fire control program was initiated. In the absence of fire, natural regeneration began to reforest many former nonstocked areas. A tree-planting program that began in earnest in the 1920's along with the public's growing acceptance of the concept of forest management, also helped to bring about the remarkable recovery of Michigan's forest over the last four decades (fig. 1).

Today the condition of the forest is still far from ideal, but a measure of the improvement that has occurred can be seen by comparing survey data for 1955 and 1966.

F-243242

F-500601

Figure 1.—The bleak scene at the left typified much of Michigan's forest land in the early 1900's. Happily, most of those denuded acres are now growing trees again, either through natural regeneration or planting. The 34-year-old red pine plantation at the right has been thinned twice, illustrating the intensive management that probably will be commonplace in many stands in the future.

Growing-Stock Volume Up 40 Percent

Michigan's 1966 volume of growing stock was 15 billion cubic feet, a 40-percent increase over the 1955 volume. The biggest share of this volume (37 percent) was in the Northern Lower Peninsula Survey Unit (fig. 2). Timber volumes also increased faster in this Unit than in any other part of the State—a 70-percent gain between the two surveys. Growing-stock volumes increased in every Unit except the heavily urbanized and agricultural Southern Lower Peninsula.

Sawtimber volume increased 43 percent between 1955 and 1966, and reached 33.9 billion board feet. [1] The increase in the Northern Lower Peninsula was a phenomenally high 115 percent during this period. The following tabulation compares growing-stock and sawtimber volumes for 1955 and 1966:

Growing stock	*1955*	*1966*
	(Million cubic feet)	
Softwoods	2,594	3,838
Hardwoods	8,119	11,187
Total	10,713	15,025
Sawtimber	(Million board feet)	
Softwoods	6,399	9,702
Hardwoods	17,358	24,161
Total	23,757	33,863

The average volume per acre of growing stock jumped from 7 cords in 1955 to 10 cords in 1966. Similarly, the average volume per acre of sawtimber rose from 1,240 board feet in 1955 to 1,790 board feet in 1966.

The distribution of timber volume by Survey Unit was as follows:

Survey Unit	*Growing-stock volume* (Percent)	*Sawtimber volume* (Percent)
Northern Lower Peninsula	37	30
Western Upper Peninsula	29	31
Eastern Upper Peninsula	22	23
Southern Lower Peninsula	12	16
Total	100	100

1 *International ¼-inch log rule.*

Hardwoods make up 74 percent of the State's growing-stock volume (table 1). The chief species are aspen and hard maple (mostly sugar maple), each of which constitutes 15 percent of the total volume. Sugar maple is an extremely valuable species, and present demand for high-quality logs and bolts exceeds the current estimate of allowable cut for this species. Growing-stock volume of most of the major species groups in each of the Survey Units has increased since 1955. Hardwoods, especially hard maple and the oaks, dominate the sawtimber volume (table 2).

Between 1935 and 1955 heavy cutting of the northern hardwood type rapidly reduced the sawtimber volumes of sugar maple, yellow birch, and hemlock (other softwoods) (fig. 3). Since 1955 sawtimber volume of nearly all species except elm has increased because of the large number of trees that have grown to sawtimber size. The major reason for the decline in elm volume is probably Dutch elm disease.

Timber volume increased in every diameter class during the 11-year period, but the greatest increases were in the smaller diameters. For example, the 1966 growing-stock volume in the 8-inch diameter class was 54 percent greater than it was in 1955 (fig. 4). These accumulating timber volumes are evidence of the recuperative phase Michigan's forests have enjoyed for the past several decades. This recuperative period will probably continue at least for another decade, and the volume in each diameter class should increase even more.

Fully two-thirds of the State's timber volume is in private ownership (individuals or companies). Farmers and miscellaneous individuals own more than half of the total growing-stock volume, and forest industry owns another 14 percent.

In addition to the volume in growing-stock trees, there is a sizeable volume in cull trees, and a small volume in salvable dead trees. Total net volume of timber on commercial forest land is 16,254.8 million cubic feet, of which 15,025.0 million cubic feet is growing-stock volume. The nongrowing-stock volume, of which only a small part is presently marketable, is distributed as follows:

Class of timber	*Volume* (Million cubic feet)
Rough trees:	
Short-log trees	250.8
Other rough trees	679.0
Rotten trees	242.7
Salvable dead trees	57.3
Total	1,229.8

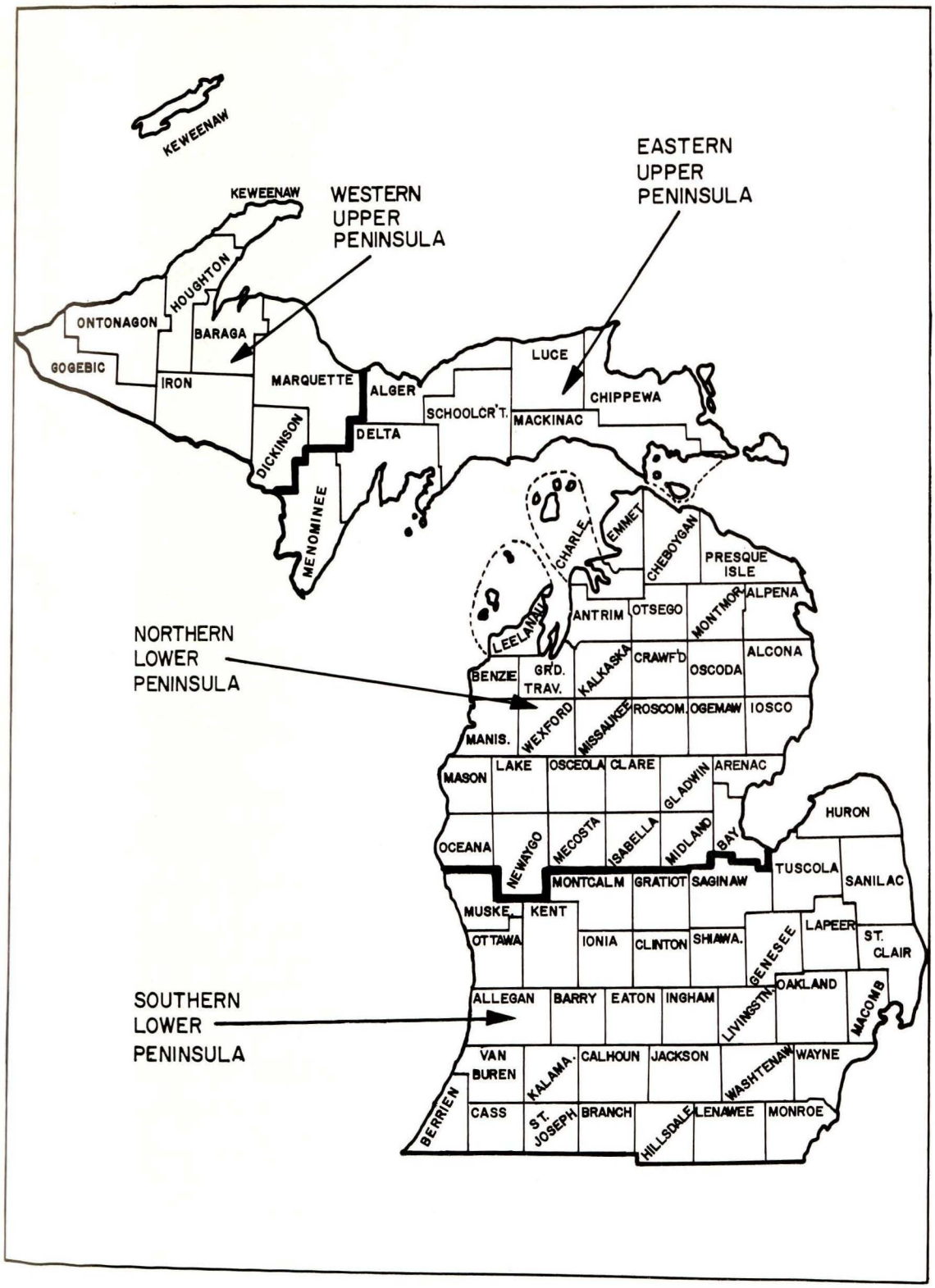


Figure 2.—Location of Forest Survey Units in Michigan, 1966.

Table 1.—Net volume of growing stock on commercial forest land by species group and percentage of total volume, Michigan, 1966

Species group	Growing-stock volume	
	Million cubic feet	Percent
Pine	1,009.6	7
Spruce	517.1	3
Balsam fir	733.5	5
Hemlock	566.7	4
Northern white-cedar	922.3	6
Other softwoods	89.2	1
Total softwoods	3,838.4	26
Oak	1,556.8	10
Yellow birch	447.8	3
Hard maple	2,234.5	15
Soft maple	1,222.2	8
Ash	559.0	4
Paper birch	625.0	4
Aspen	2,257.1	15
Elm	751.4	5
Other hardwoods	1,532.8	10
Total hardwoods	11,186.6	74
All species	15,025.0	100

Table 2.—Net volume of sawtimber on commercial forest land by species group and percentage of total volume, Michigan, 1966

Species group	Sawtimber volume	
	Million board feet[1]	Percent
Pine	3,267.5	10
Hemlock	2,793.8	8
Northern white-cedar	1,860.3	6
Other softwoods	1,780.5	5
Total softwoods	9,702.1	29
Oak	4,123.2	12
Yellow birch	1,473.0	4
Hard maple	5,830.1	17
Soft maple	2,382.4	7
Basswood	1,051.0	3
Beech	1,571.7	5
Aspen	2,684.0	8
Elm	1,942.5	6
Other hardwoods	3,103.3	9
Total hardwoods	24,161.2	71
All species	33,863.3	100

1/ International 1/4-inch rule.

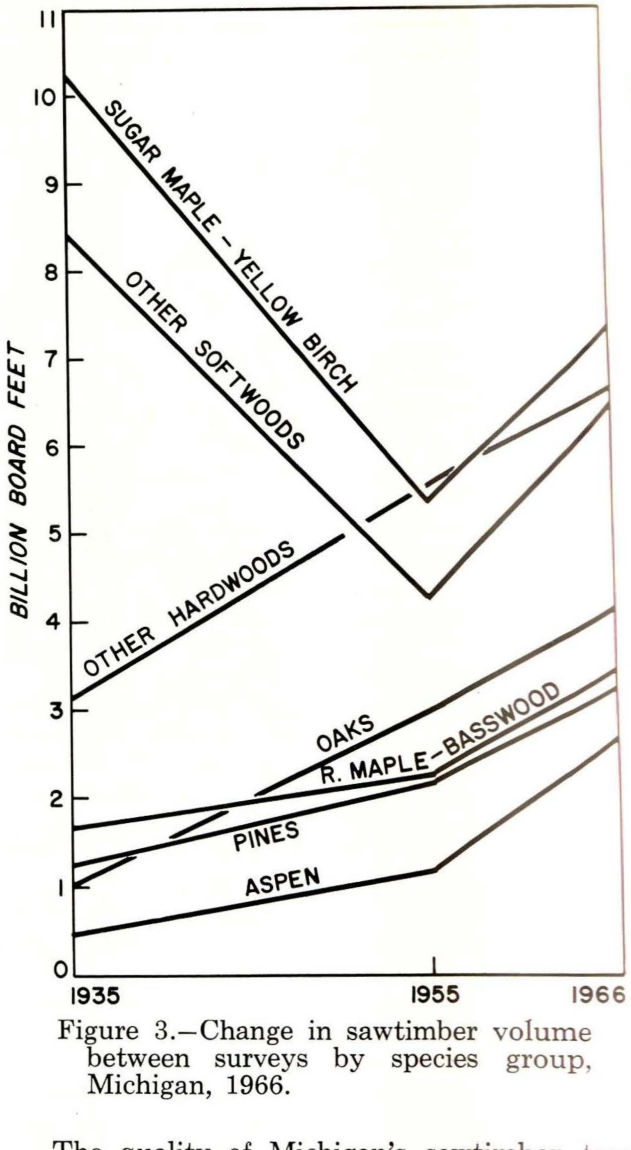


Figure 3.—Change in sawtimber volume between surveys by species group, Michigan, 1966.

The quality of Michigan's sawtimber trees was estimated by grading the butt log of about one-third of the sawtimber trees sampled during the 1965 survey. (Log grade standards used for each species are described in the Appendix.) The estimated percentage of butt logs in each log grade is shown in the following tabulation:

	Softwoods	*Hardwoods*
Grade 1	3	21
Grade 2	8	37
Grade 3	82	40
Grade 4	7	2
Total	100	100

The above information is more meaningful if it is converted into the "log grade mix" that the whole tree should yield. This is true because the butt log usually contains the highest grade log in a tree and about 45 percent of the whole

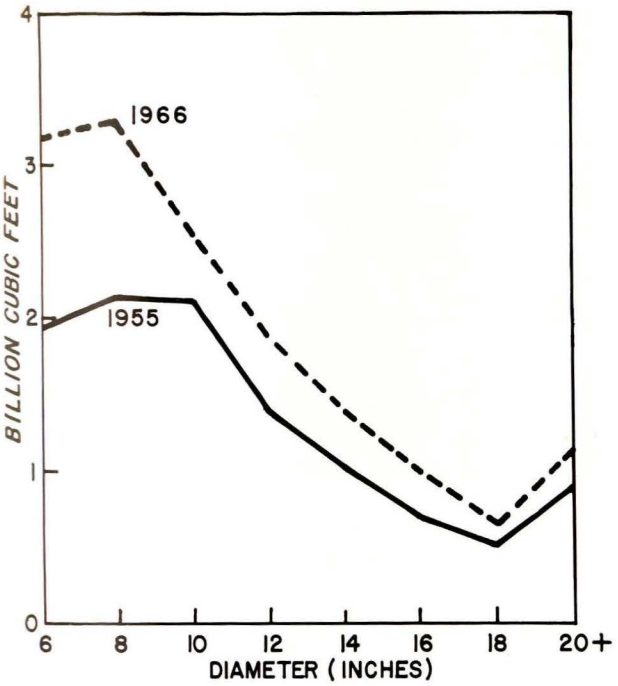


Figure 4.—Distribution of growing-stock volume by diameter class, Michigan, 1955 and 1966.

tree volume in northern hardwoods. A study[2] conducted by the Michigan Technological University provided a means of making this conversion for hardwoods, but similar information for softwoods is not yet available. The percentage of hardwood-tree volume in each log grade is practically the same as the percentage of butt logs in each grade:

	Hardwoods
Grade 1	18
Grade 2	37
Grades 3 and 4	45
Total	100

Growth Is on the Upswing

Net annual growth on growing stock was 580 million cubic feet in 1965, an 18-percent gain over that of 1954. Nearly one-fourth of the net growth was ingrowth, the net volume of small trees that grew into poletimber size during the year. The remainder of the growth was increment on trees already 5 inches d.b.h. (diameter at breast height) and larger:

	Net annual growth on growing stock (Thousand cubic feet)
Ingrowth	133,386
Growth on growing stock	446,171
Net growth	579,557

The net annual growth rate in 1966 averaged a respectable 3.9 percent of the inventory of growing stock, about 1 percent less than in 1954. Growth rates for individual species ranged from 10 percent for red pine to about 1 percent for hemlock and elm.

A high volume of mortality prevented net growth from being higher (because mortality is subtracted from gross growth to arrive at net growth). Mortality in 1965 was equal to about 30 percent of the gross growth:

	Thousand cubic feet
Gross growth	823,410
Mortality	243,853
Net growth	579,557

However, two-thirds of the above mortality is concentrated in four species. Quaking aspen alone accounted for 32 percent of the mortality, balsam fir 11 percent, elm 10 percent, and bigtooth aspen 9 percent. Table 3 shows the effect mortality had on the net growth of these four species in 1965.

Table 3.—Volume of growing-stock gross growth, mortality, and net growth for selected species, Michigan, 1965
(In thousand cubic feet)

Species	Gross growth	Mortality	Net growth
Quaking aspen	112,841	78,640	34,201
Balsam fir	55,759	25,737	30,022
Bigtooth aspen	50,425	22,288	28,137
Elm	30,742	23,972	6,770

Diseases were responsible for almost half of the mortality. Hypoxylon canker (affecting aspen) and Dutch elm disease were two of the most serious diseases. Other causes of mortality were insects, suppression by trees or other vegetation, and a variety of less common causes. Short-lived species like aspen and balsam fir are sometimes too scattered to be economically available for harvest; therefore, they suffer much loss from overmaturity.

[2] *Meteer, J. W. Butt log tree grades analyzed. Mich. Tech. Univ., Ford Forest. Center, Res. Note 2, 8 p. 1966.*

The 2 billion board feet of net annual growth of sawtimber in 1965 represents a 75-percent gain over the 1954 growth. Less than 10 percent was ingrowth:

	Net annual growth on sawtimber (Thousand board feet)
Ingrowth	131,863
Growth on sawtimber	1,856,787
Net growth	1,988,650

The sawtimber net annual growth rate was 5.9 percent of the inventory—somewhat higher than for growing stock.

Sawtimber mortality was 21 percent of gross growth, compared with 30 percent for growing stock mentioned earlier:

	Thousand board feet
Gross growth	2,524,315
Mortality	535,665
Net growth	1,988,650

The four species with the greatest volume of sawtimber mortality were quaking aspen, bigtooth aspen, elm, and hemlock (table 4). Quaking aspen accounted for 22 percent of the total sawtimber mortality and had the highest mortality rate (7.2 percent of its sawtimber inventory).

Table 4.—Volume of sawtimber gross growth, mortality, and net growth for selected species, Michigan, 1965
(In thousand board feet)[1]

Species	Gross growth	Mortality	Net growth
Quaking aspen	294,421	118,521	175,900
Bigtooth aspen	168,355	55,915	112,440
Elm	118,946	78,646	40,300
Hemlock	84,602	32,332	52,270

1/ International 1/4-inch rule.

Maple-Beech-Birch is Predominant Forest Type

The maple-beech-birch type is found on 5.2 million stocked acres, or on 28 percent of the stocked commercial forest area (fig. 5). The next most extensive forest type is aspen-birch with 4.5 million stocked acres.[3] During the 1935 and 1955 surveys the aspen-birch type covered the largest area (fig. 6), but in 1966 it slipped to second place. Aspen, a pioneer species, became established on many burned-over areas in Michigan. Decline of the aspen-birch type, then, is due partly to natural plant succession as more shade-tolerant species replace these postfire species. Inadequate harvesting of mature and overmature aspen-birch stands, and premature harvest of immature stands, have probably also contributed to this decline.

Figure 5.—A thinned maple poletimber stand. The maple-beech-birch forest type has the largest area of any type in Michigan. Also, poletimber is the most extensive stand-size class in the State. (Photo courtesy of Kimberly-Clark Corporation.)

The other four major forest types occupy much smaller areas and are less widely distributed over the State (see forest type map inside back cover).

Most of Michigan's timber stands are young—half of them are under 40 years old and another third are between 40 and 70 years of age. The average rotation age, or age at which mature timber in a stand is harvested, is different for each forest type. A short-lived species like jack pine should be harvested much sooner than a long-lived species like sugar maple to avoid excessive mortality. Nearly every forest type has

3 *The forest-type areas shown in figure 6 do not agree with those given in the Appendix tables because the tables include nonstocked areas within each type. Nonstocked areas were not classified as to forest type in 1935 and 1955.*

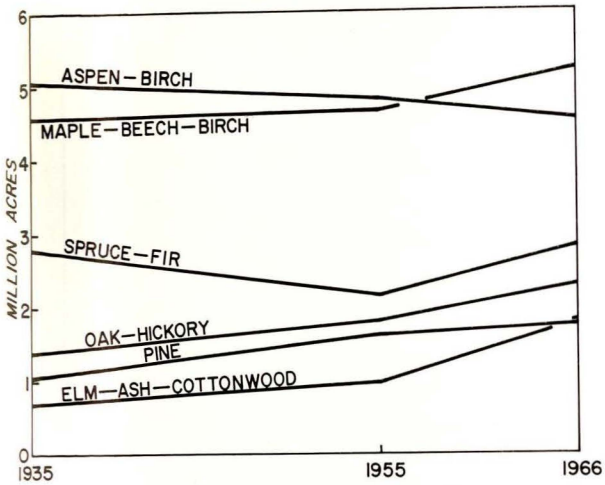


Figure 6.—Area of stocked commercial forest land by forest types, Michigan, 1935, 1955, and 1966.

some stands that are overmature (over rotation age), and for every type the distribution of area by age classes is less than ideal. An ideal even-aged forest would have an equal area of each type in each 10-year age class, and have no overmature timber.

The present stand-age distributions of some of the forest types in the State are compared with the desirable distributions in figure 7. The graphs indicate relatively large areas of overmature aspen and cedar, and accelerated harvesting in mature and overmature stands of these types is highly desirable.

Overall Stocking is Good, But "Desirable" Trees in Short Supply

Tree stocking is expressed as a percent of the minimum stocking required to make full use of the site. Stocking is measured in terms of basal area per acre for trees 5.0 inches d.b.h. and larger in numbers of trees per acre for smaller trees. On this basis, the stocking of all live trees (growing-stock and cull trees) and of growing-stock trees is high in Michigan. Seventy percent of the commercial forest area is well stocked (70 percent stocking or more) with live trees and 51 percent is well stocked with growing-stock trees. Only 9 percent of the area is lightly stocked (10 to 40 percent stocking) with live trees and 16 percent is lightly stocked with growing-stock trees. However, 15 percent of the commercial forest area was more open than tree-covered (less than 50 percent stocked). Also, 27 percent of the area was less than 50 percent stocked with growing-stock trees.

In contrast, the stocking of "desirable" [4] trees—those healthy, vigorous, defect-free trees that are most likely to produce valuable products and survive to maturity—is very low. Only about 1 percent of the commercial area is well stocked with desirable trees, while 46 percent of the area is lightly stocked with them.

The kind of trees land managers prefer as timber crop trees are scattered sparsely over Michigan's generally thick forests. However, the number of desirable trees should increase as protection from fire, insects, and disease continues to improve and as better cutting practices and timber stand improvement efforts pay dividends.

Another way of assessing the condition of the forests in Michigan is to look at the proportion of cull trees. Almost 20 percent of the live trees are cull (rough or rotten) trees that presently have little or no commercial value, although they occupy growing space (fig. 8):

	Percent of all live trees
Growing stock trees (over 1 inch d.b.h.):	
Saplings (1 to 5 inches d.b.h.)	51
Poles and sawtimber trees:	
Desirable	7
Acceptable	23
Cull trees:	
Rough trees (over 1 inch d.b.h.)	16
Rotten trees (over 1 inch d.b.h.)	3
All live trees (over 1 inch d.b.h.)	100

Three-fourths of all sound, live trees at least 1 inch in d.b.h. are small—less than 5 inches d.b.h. As mentioned earlier, many stands in Michigan are young. The small, vigorous trees usually associated with such stands represent a high potential for the State's forests.

The methods for determining the potential productive capacity of forest land are still being developed, but site index [5] provides some idea of the present productivity of these lands. The most productive land usually grows the tallest

---

[4] *Live trees are classed by Forest Survey as either desirable, acceptable, rough, rotten, or short sawtimber. See Appendix for definitions.*

[5] *Site index is the height in feet of average dominant and codominant trees at 50 years of age. For example, "site index 60" for red pine means that the height of dominant or codominant trees in that area average 60 feet at 50 years of age.*

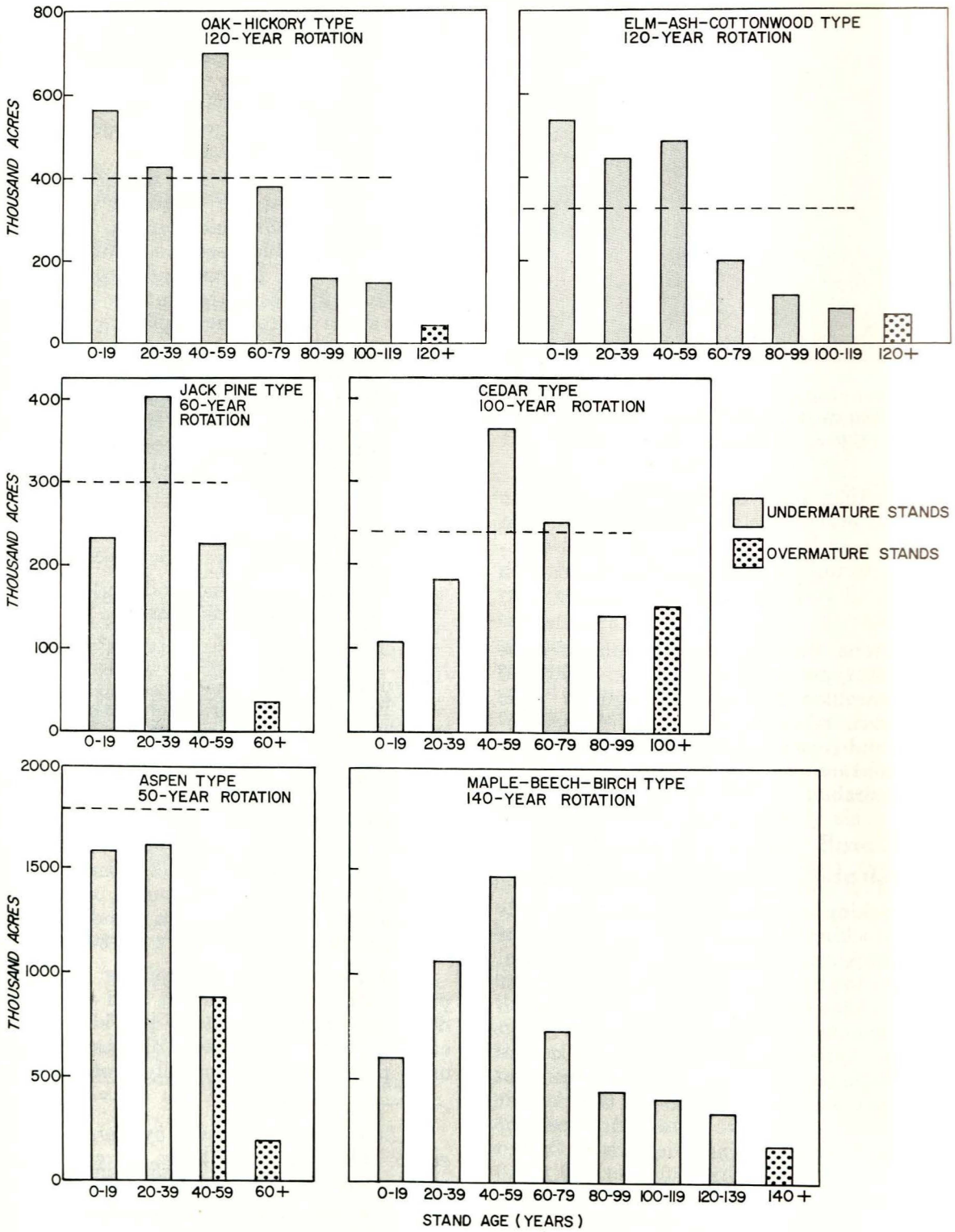


Figure 7.—Area of forest types by stand-age class and desirable area based on rotations suggested for average sites in Michigan, 1966. Broken lines show desirable level for rotation shown. (No desirable level shown for the maple-beech-birch type because this type is usually managed under all-aged conditions.)

Figure 8.—Cull trees, like the rotten tree above, make poor use of growing space and contain a smaller amount of usable wood than growing-stock trees. Cull trees account for 19 percent of the total number of live trees in Michigan, but only 7 percent of the cubic-foot volume. The benefits from removing such trees are obvious. (Photo courtesy of Michigan Department of Natural Resources.)

trees at a given index age (50 years in this report). Site index varies widely by species, but forest land in the Midwest can be described roughly as follows:

	Site index class
Poor	55 or less
Average	56 to 70
Good	More than 70

Using the above classification, in 1966 almost 20 percent of Michigan's commercial forest area was comprised of good sites and 40 percent was comprised of average sites.

Commercial Forest Area Declining

The area of commercial forest land in Michigan changed from 19.0 million acres in 1935 to 19.1 million acres in 1955, and declined to 18.9 million acres in 1966. Although these differences are minor, the long-term trend seems to be toward a declining area as the commercial forest gives way to highways, powerlines, reservoirs, and urban, recreational, and industrial developments. This withdrawal is only partially offset by reforestation of crop and pasture land (fig. 9).

F-506023

Figure 9.—Newly planted red pine seedlings in Wexford County. Despite a vigorous tree planting program (over 1-1/4 million acres planted), the commercial forest area in Michigan continues to decline because of competing needs for land by an increasing population.

During the last 12 years the commercial forest area has declined an average of 18,400 acres per year. Estimates of future commercial area suggest that this reduction will accelerate to about 44,000 acres per year over the next three decades.

The change in commercial forest area was not uniform throughout the State – it decreased slightly in the Upper Peninsula, decreased considerably in the Northern Lower Peninsula, and increased considerably in the Southern Lower Peninsula. The latter increase was probably due to idle cropland and pasture returning to forest, widespread tree planting on open land, and decreasing use of farm woodlots for pasture.

Increases in commercial forest area do not immediately bring about corresponding increases in timber volume, although loss of commercial area does usually result in immediate loss of timber volume. Lands added to the commercial forest are principally stocked with seedlings and saplings, and therefore contain little volume. This could explain why commercial forest area increased by 400 thousand acres in the Southern Lower Peninsula between 1955 and 1966, and yet timber volume dropped. In the other three Units increasing timber volumes were large enough to allow net volume gains despite net area losses.

The Upper Peninsula is the most heavily forested part of Michigan (fig. 10). Commercial forests grow on more than three-fourths of the land area of each county in the Upper Peninsula except Keweenaw County, where Isle Royale National Park has been reserved for recreational use. Most counties of the Northern Lower Peninsula are more than 50 percent commercial forest. Even in the agricultural and urbanized Southern Lower Peninsula only one county (Wayne) is less than 10 percent commercial forest land. Over the State, commercial forests constitute 52 percent of the total land area.

Poletimber Becomes Dominant Stand-Size Class

In 1966 poletimber stands represented 43 percent of Michigan's commercial forest area, more than any other stand-size class. In 1955 sapling and seedling stands covered 36 percent of the area, and poletimber stands accounted for only 32 percent. Table 5 shows the advance of trees into larger diameter classes as the dominant stand-size class changed from sapling and seedling in 1935 to poletimber in 1966.

Much of what appears to be a dramatic reduction in nonstocked area between 1955 and 1966 is not actual change. Improved sampling procedures used in the latest survey, which require more precise determination of the presence or absence of trees on the sample location, have given more accurate information on the amount

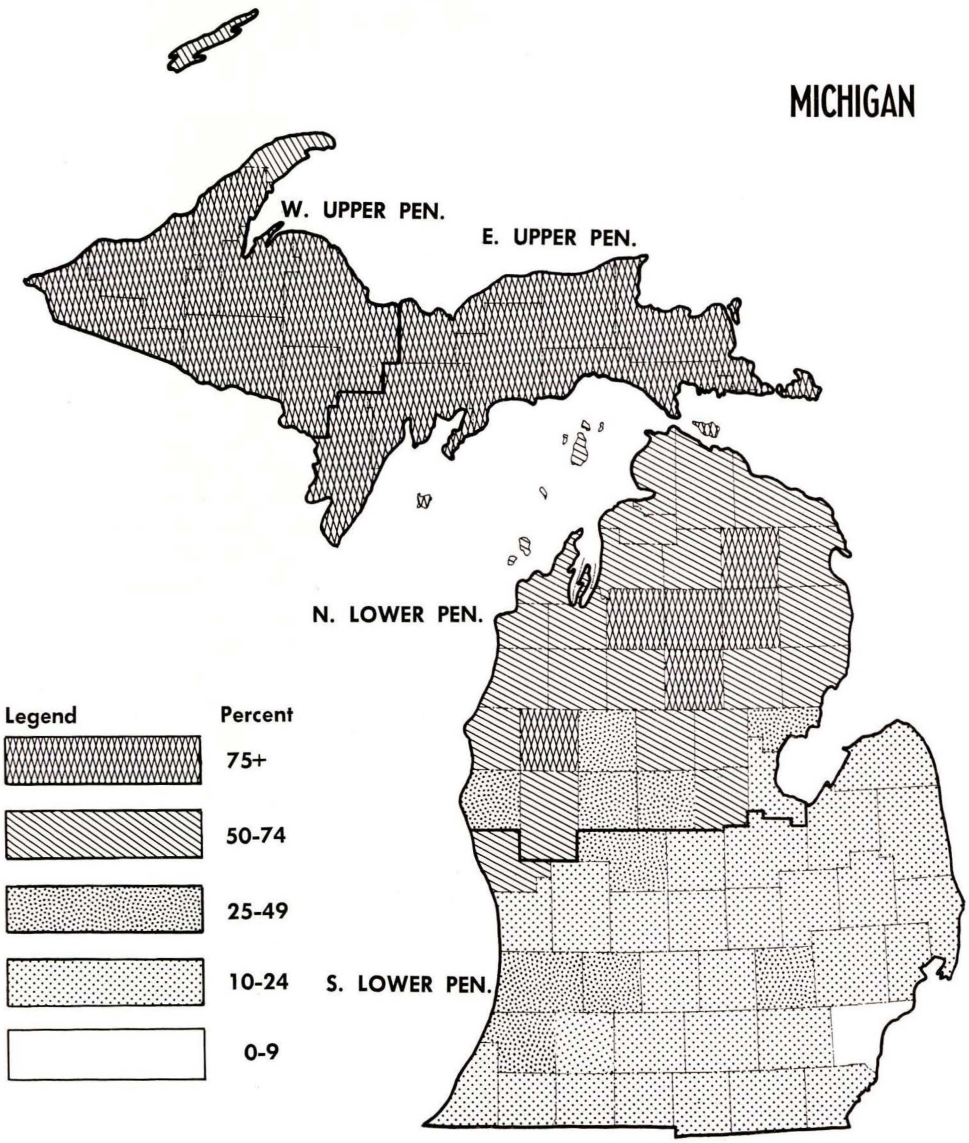


Figure 10.—Commercial forest area as a percent of all land area, 1966.

Table 5.—Area of commercial forest land by stand-size class in Michigan, 1935, 1955, and 1966

(In thousand acres)

Stand-size class	1935	1955	1966
Sawtimber	3,151	3,008.1	4,723.2
Poletimber	3,404	6,119.6	8,205.8
Sapling and seedlings	8,913	6,845.4	5,432.8
Nonstocked areas	3,582	3,147.8	538.4
Total	19,050	19,120.9	18,900.2

of nonstocked commercial forest land. Unfortunately, however, meaningful comparisons of the areas of nonstocked forest in 1955 and 1966 cannot be made because of this changed procedure. It is certain that the nonstocked area has decreased between surveys as a result of natural regeneration and, to a lesser extent, tree planting. However, some formerly stocked commercial forest land has become nonstocked as a result of the failure of natural regeneration following timber harvesting on some jack pine and aspen sites.

TIMBER USE

Growing-Stock Removals Gained Since 1954

Growing-stock removals from commercial forest land in 1965 were estimated to be 206 million cubic feet, a 16-percent increase over 1954 removals. Timber removals include not only trees harvested, but trees cut or destroyed by thinnings, land clearing, or changes in land use.

About one-third of the 1965 removals came from the Northern Lower Peninsula; this Unit also showed the largest increase (about 70 percent) in removals since 1954. During the same period, removals in the Southern Lower Peninsula dropped 23 percent. Hardwoods, chiefly the aspens, accounted for three-fourths of the volume removed.

Growing-stock removals in 1965 amounted to about 1.4 percent of the inventory and about 36 percent of the net growth. Under ideal conditions, timber removals would closely approach or equal net growth. However, because only a portion of the growth can be cut in Michigan's young and rebuilding forests, a direct comparison between growth and removals is of little value. A better comparison is between allowable annual cut and timber removals. Allowable (desirable) annual cut is the average net volume of timber that it is advisable to cut annually on commercial forest land to maintain or increase the level of growing stock and to bring about a better distribution of age classes. The annual cut is calculated for a 10-year period, and includes harvest and improvement cuts yielding 3 cords or more per acre and one-tenth of the entire net volume of stands beyond rotation age. Annual allowable cut is determined on the basis of total commercial volume present regardless of its current economic availability. An unknown amount of the allowable cut volume is unavailable for logging because of location, quality or quantity of the timber, lack of markets, or unwillingness of some owners to sell. For these reasons allowable cut can only be used as a guide to compare with timber removals.

Removals of Growing Stock Far Below Allowable Cut

Michigan's annual allowable cut from growing stock between 1966 and 1975 will be an estimated 380 million cubic feet, compared with 206 million cubic feet of actual removals in 1965. Timber removals can be increased about 84 percent above the 1965 level and still be within the allowable cut. Removals can be more than doubled in the Eastern Upper Peninsula and almost doubled in the Western Upper and Northern Lower Peninsula, but are presently about 45 percent greater than allowable cut in the Southern Lower Peninsula.

The 1965 sawtimber removals amounted to 823 million board feet, 50 percent more than in 1954. These removals were 2.4 percent of the current sawtimber inventory and 40 percent of the current net growth. The aspens provided 23 percent of the sawtimber removals, followed by sugar maple with 16 percent and elm with 8 percent. The Western Upper Peninsula and the Northern Lower Peninsula each contributed about 30 percent of the State's sawtimber removals. The other two Units each provided approximately 20 percent of the total removals.

Sawtimber removals in 1965 were about 90 percent of the allowable annual cut, which was estimated to be 910 million board feet. Even though removals were close to the allowable cut over the State as a whole, the situation in individual Survey Units was less satisfactory. Sawtimber removals in the Southern Lower Peninsula were about 80 percent greater than allowable cut, and removals in the Upper Peninsula were nearly 30 percent less than allowable cut. The overcutting in the Southern Lower Peninsula is the result of rapid urbanization and consequent timber harvesting on lands slated for development, and the effect of increasingly shorter tenure of ownership.

When the volumes of removals and allowable cut for each species are compared, the underutilized species (removals less than allowable cut) may be separated from the overutilized ones (removals greater than allowable cut) (table 6).

The growing-stock harvest of every species except jack pine could be increased. On the other hand, sawtimber removals are greater than allowable cut for a number of species – most notably elm, hard maple, aspen, and jack pine (fig. 11). For several species this apparent overcutting of sawtimber trees is not a problem, but for other species it is a matter of some concern. For example, elm presents a special case because of present and expected high mortality due to Dutch elm disease. This disease is particularly severe in the southern portion of the Lower Peninsula. It has not yet killed a large volume of elm in the Upper Peninsula, but it may do so in the future

Table 6.—Volume of growing stock and sawtimber underutilized and overutilized by species, Michigan, 1965

Species	Underutilized		Overutilized	
	Growing stock	Sawtimber	Growing stock	Sawtimber
	Thousand cu. ft.	Thousand bd. ft. 1/	Thousand cu. ft.	Thousand bd. ft. 1/
White and red pine	9,711	49,001	--	--
Jack pine	--	--	5,592	32,680
Spruce	10,095	10,020	--	--
Balsam fir	25,642	18,039	--	--
Northern white-cedar	29,591	89,231	--	--
Hemlock	7,129	32,359	--	--
Oak	3,415	--	--	10,162
Yellow birch	3,660	--	--	1,010
Hard maple	15,870	--	--	16,772
Soft maple	13,983	5,927	--	--
Beech	4,200	11,797	--	--
Ash	6,456	4,939	--	--
Balsam poplar	9,680	21,670	--	--
Aspen	14,682	--	--	2/ 69,974
Basswood	4,318	--	--	1,489
Elm	2,216	--	--	26,754
Paper birch	14,770	5,657	--	--
Other species	2,628	--	--	2,506

1/ International 1/4-inch rule.
2/ It is usually desirable to harvest aspen sawtimber as soon as trees become mature to prevent excessive mortality. This species becomes mature on average sites soon after reaching sawtimber size.

unless an efficient means of control is found. Elm removals in 1965 were far below allowable cut in the Upper Peninsula but far above allowable cut in the Lower Peninsula, reflecting the pattern of spread of the disease. The present estimate for allowable cut of elm in the Lower Peninsula is probably too low, because the area control method that was used to calculate allowable cut does not properly cope with a situation where disease threatens to virtually eliminate a species. A more meaningful allowable cut for elm in the Lower Peninsula would probably be close to the volume currently being removed.

F-519589

Figure 11.—Tractor operator releasing tongs from mature sugar maple saw logs after skidding them out to a logging road. Sawtimber removals over the State in 1965 were only slightly less than the estimated annual allowable cut. Sugar maple sawtimber removals, however, were greater than allowable cut.

Also, because aspen on average sites usually matures soon after reaching sawtimber size and begins to suffer heavy defect and mortality losses, it is desirable to harvest sawtimber trees as quickly as possible. The same is not true on superior sites where healthy trees can be grown for longer periods of time.

The overcutting of jack pine is a serious problem, however, and represents a big drain on the inventory of this species.

Roundwood Output Gains — Especially Pulpwood

After a long history of general decline, the output of roundwood products (all timber products from roundwood such as logs, bolts, and limbwood) in Michigan may be ready for a period of increase (fig. 12). As discussed in the following paragraphs, the primary reason for this optimistic outlook is that pulpwood output is expected to continue to climb. Comparison of output in 1965 with that in 1954 shows a 68 percent increase for pulpwood, and decreases for all other major products. Pulpwood constituted more than half of the State's roundwood output in 1965:

Products	*Output* (Million cu. ft.)	*Percent*
Pulpwood	103.8	52.8
Saw logs and bolts	57.2	29.1
Miscellaneous industrial wood	6.8	3.4
Veneer logs and bolts	3.1	1.6
All other products	25.8	13.1
All products	196.7	100.0

It is likely that the output of pulpwood will continue to expand, especially since technology now permits use of hard hardwoods in the pulping process. The short wood-fiber length, which characterizes this group of species, previously limited use of hard hardwoods as pulpwood. But because pulpwood demand is increasing, industry is adapting to the use of short-fibered species.

Pulpwood output increased in every Survey Unit between 1954 and 1965, but it gained most rapidly in the Northern Lower Peninsula, where 40 percent of the State's pulpwood was produced in 1965. Pulpwood harvesting per unit of stocked commercial forest was most intense in Isabella and Menominee Counties. The 1965 output of saw logs and bolts was higher than the 1954

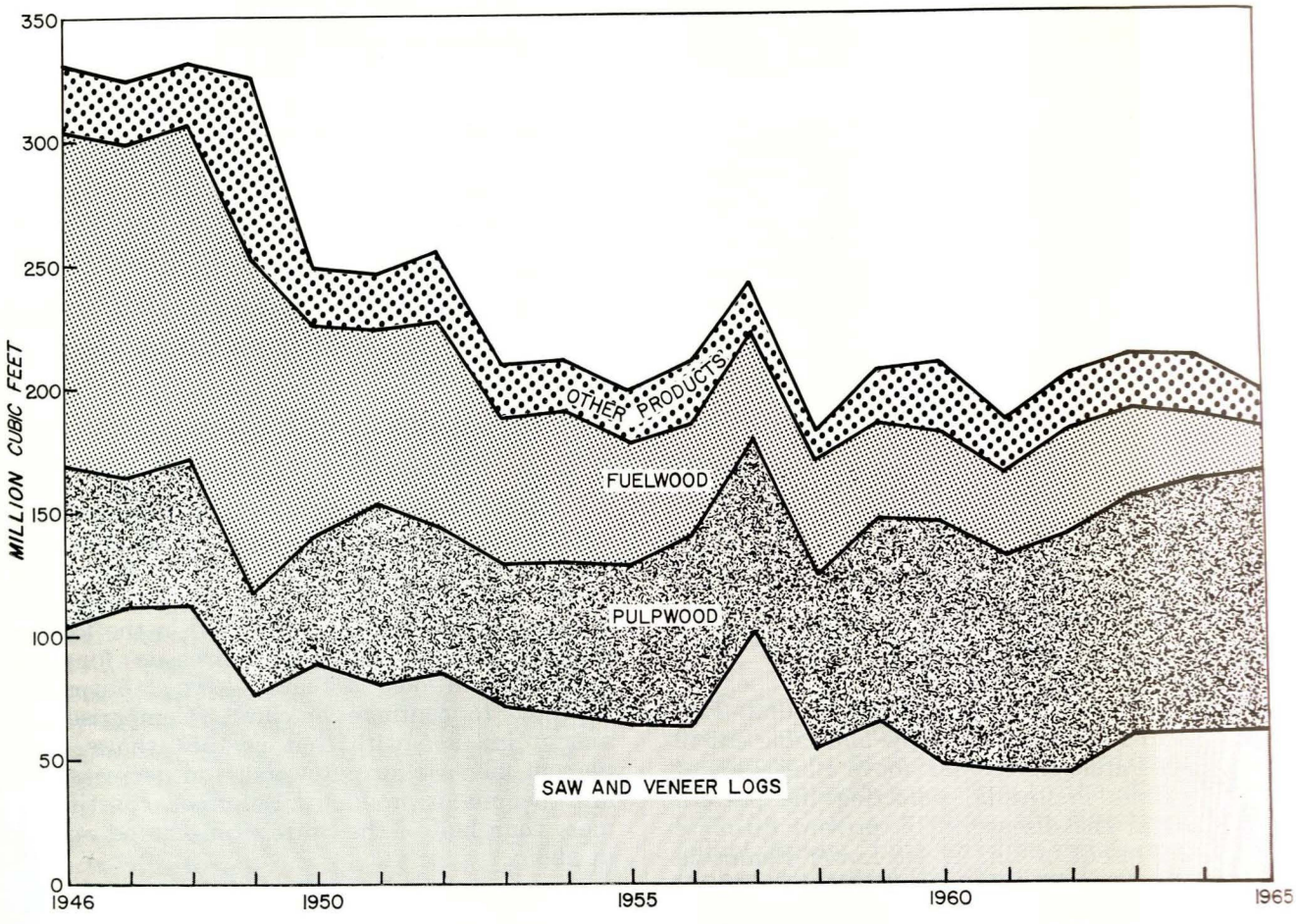


Figure 12.—Output of roundwood products in Michigan, 1946 to 1965. Points for some years are based on trend-level curves because survey data are not available for every year.

output in the Lower Peninsula, but lower than the 1954 amount in the Upper Peninsula. Output in the Southern Lower Peninsula doubled, accounting for one-third of the State's total production of saw logs in 1965. Veneer-log and bolt production, half of which came from Western Upper Michigan in 1965, dropped in all Units except the Northern Lower Peninsula.

Some idea of the importance of the forest to Michigan's economy is seen in the value of the rough forest products delivered to the mill. In 1965 these products were worth an estimated $50.9 million. Pulpwood accounted for about 47 percent of this total value, saw logs 37 percent, and other products 16 percent.

An estimated 19,350 man-years of employment were provided in primary timber-based jobs in Michigan during 1965 – including timber harvesting (6,850 man-years), primary manufacturing (9,300 man-years), and forest management (3,200 man-years). The pulp and paper industry provided most of the jobs – 45 percent of the timber harvesting employment and 43 percent of the manufacturing employment. Timber harvesting workers earned more than $25 million in 1965 and timber-based primary manufacturing employees earned more than $50 million. Those engaged in forest management work earned $19 million.

Most of Michigan's Roundwood Exports Go to Wisconsin

One-quarter of the volume of roundwood that is harvested in Michigan is exported to other States or Canada for manufacture or processing. Most of these exports are pulpwood, but small amounts of saw logs and veneer logs are also shipped out of State. In 1965 primary mills in Michigan consumed only 131 million cubic feet

of an output of 171 million cubic feet. These figures and those in the tabulation below do not include piling, poles, mine timbers, posts, or fuelwood, because consumption data are not available for these products. The following tabulation shows output and consumption in 1965 for major forest products:

Product	*Output*	*Consumption*
	(Million cubic feet)	
Pulpwood	103.8	65.2
Saw logs and bolts	57.2	57.4
Miscellaneous industrial wood	6.8	6.8
Veneer logs and bolts	3.1	1.7
All products	170.9	131.1

Two-thirds of the veneer logs and virtually all of the saw logs and pulpwood exported from Michigan were shipped to plants in Wisconsin. Michigan imported some veneer logs and pulpwood, but the volume imported was only a fraction of that exported. Saw log imports, however, were slightly greater than exports.

Between 1954 and 1965, consumption of veneer logs fell about 60 percent and saw logs about 20 percent. During the same period consumption of pulpwood doubled and there was a gain of 14 percent in the use of miscellaneous industrial wood, resulting in a net increase in total consumption in 1965 over that of 1954.

Every Survey Unit had an excess of output over consumption in 1965 except the Southern Lower Peninsula (fig. 13). For the Lower Peninsula as a whole, however, output and consumption were nearly equal.

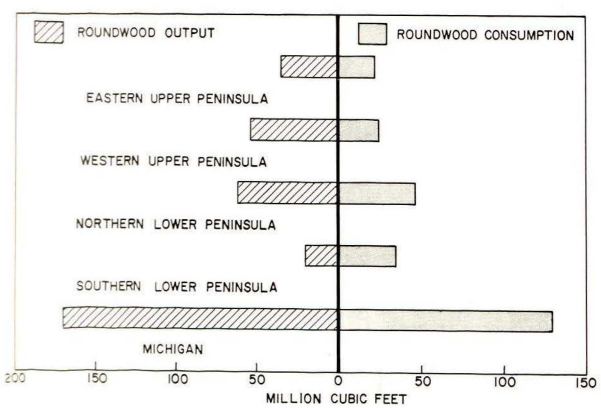


Figure 13.—Comparison of roundwood output and consumption by Forest Survey Unit, Michigan, 1965.

Total roundwood output in 1965 amounted to 196.7 million cubic feet, somewhat lower than the 227.5 million cubic feet in 1954. These two figures include volumes for piling, poles, mine timbers, posts, and firewood.

Roundwood Consumption Rises Despite Decline in Number of Small Mills

Between 1954 and 1965 the number of primary wood-using plants in Michigan plummeted from 2,100 to 437 (fig. 14). In general, the plants that closed were smaller and less efficient than those that remained in operation.

By 1965, only 266 out of 1,866 [6] small sawmills that had operated in 1954 were in production. The number of large and medium-sized sawmills increased from 96 to 122 during the same period, with increases in every Survey Unit except the Western Upper Peninsula.

The number of pulpmills in Michigan dropped from 11 to 10 in the 11 years between surveys. The Eastern Upper Peninsula and Southern Lower Peninsula each lost one pulpmill, and the Western Upper Peninsula gained one. Pulp production per mill increased significantly since 1954. Prospects for increased pulpmill capacity and number of mills in the near future are good. Some present mills are planning on expanding and at least one company is considering a new plant. Pulping processes that permit use of short-fibered hardwoods will probably receive high consideration in any new expansion planning.

Nearly half of Michigan's veneer mills shut down between 1954 and 1965, the number of mills decreasing from 23 to 12. All of the mills that closed were container veneer mills that produced material for cartons and boxes to be used largely for produce. When paper and plastic containers began to dominate the market, those container veneers mills that could not shift to supplying other markets were forced to close. Six of the mills that closed were in the Southern Lower Peninsula and four were in the Eastern Upper Peninsula. The number of face and core veneer mills in the State remained at four.

Closure of miscellaneous primary wood-using plants was especially severe. Between 1954 and 1965, their numbers tumbled from 102 to only 26, the decline being general throughout the State. Only 1 particleboard mill, 1 shingle mill, 1 special-

6 *A small but unknown number of these small sawmills were idle in 1954.*

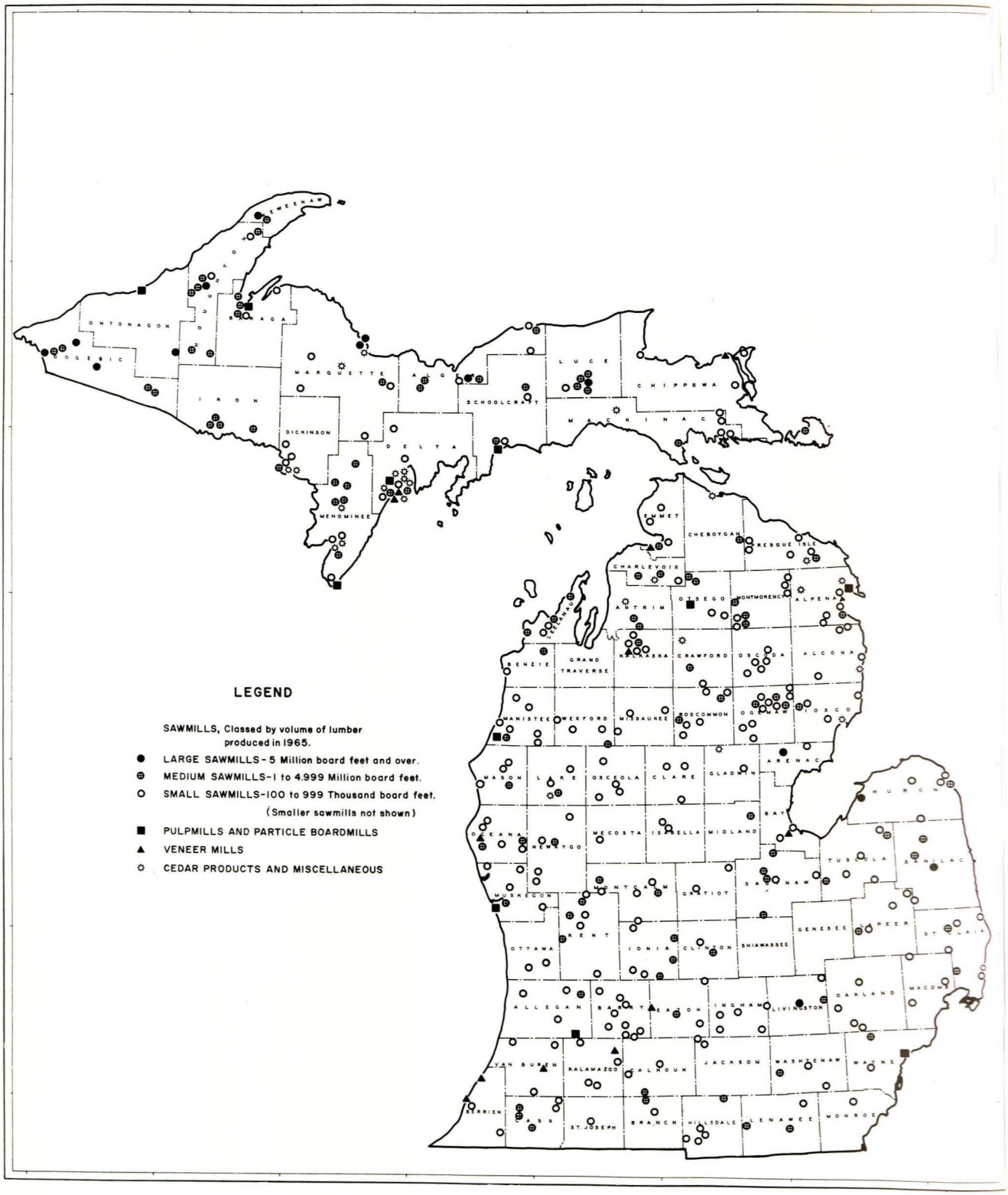


Figure 14.—Primary wood-using mills and plants by type of mill and county, Michigan, 1965.

ty plant, 1 combination post and pole yard and fence plant, 2 wood-turning plants, 5 log cabin manufacturing plants, 5 wood-treating plants, and 10 fence plants were in operation in 1965.

Total consumption of roundwood by all primary mills increased about 18 million cubic feet between surveys in spite of the closing of so many wood-using plants. Pulpwood consumption doubled even though there was one less pulpmill in 1965 than in 1954. The number of sawmills in 1954 was reduced by 80 percent in 1965, but consumption of saw logs and bolts at the remaining mills was reduced only 20 percent. The opposite was true of veneer logs and bolts, where the rate of consumption dropped faster than the rate of reduction in number of mills. In summary, the closing of mills meant that timber products had to be transported farther to markets, but it had no direct effect on the total volume of raw material used by the remaining mills.

THE FUTURE

Use of industrial wood in the United States is expected to rise about 2.5 percent per year between 1967 and 1985.[7] The 11.6 billion cubic feet consumed nationwide in 1967 will jump to 18 billion cubic feet in 1985 if the assumptions made prove correct. The rate of increase differs sharply by industry. For example, the demand for pulpwood is projected to increase at the rate of 3.6 percent annually, demand for plywood and veneer logs at 3.1 percent, and demand for saw logs only 0.9 percent.

Pulpwood use nationwide for supplying domestic and export markets is estimated to climb from 71.3 to 142 million cords between 1967 and 1985. Most of this increased demand must be met in the North, the Rocky Mountains, and Canada. Although the South has been a big supplier of the nation's pulpwood (47 percent of the total in 1967), only about 10 million additional cords are available there, assuming half of the present excess volume of growth over timber removals could be used as pulpwood. Northern forests could supply approximately 17 million additional cords of roundwood mostly in hardwood species, assuming half of the present excess volume of growth over removals could be used as pulpwood. (The additional volumes could be higher if plant residues, logging residues, and thinnings are included.)

Michigan's Output of Timber Products Projected to Double in 30 Years

With the growing national consumption of wood and the advantage enjoyed by the North in being able to provide a good share of the added pulpwood demand, the market outlook for Michigan's forest products is bright. A projection of timber products output in Michigan between 1965 and 1995 indicates big increases in the harvest of pulpwood (fig. 15), veneer logs, and miscellaneous industrial products,[8] a small increase in the cut of saw logs, and a big reduction in the cut of fuelwood. The 1995 output of pulpwood is expected to be 70 percent of the total roundwood output, compared with only 53 percent in 1965 (fig. 16).

Despite this projected increase in timber consumption, the level of primary timber-based employment[9] is expected to decline from 19,000 man-years in 1965 to 15,000 man-years in 1995. Only the employment of persons engaged in forest management is expected to rise continually (fig. 17). The trend toward greater mechanization in the woods, and automation in the mill and plant are the big reasons for the projected employment decline. However, the greater productivity that results from improved technology

---

7 *From a recent interim projection by the U.S.D.A. Forest Service reported in a speech by H. R. Josephson, Director, Division of Forest Economics and Marketing Research, U.S.D.A. Forest Service, titled, "Availability of Wood Supplies for the Pulp and Paper Industry," February 20, 1968.*

8 *Miscellaneous industrial products include particleboard bolts, poles, pilings, mine timbers, posts, chemical wood, box bolts, and an assortment of other items.*

9 *Includes employment in forest management, timber harvesting, and primary manufacturing plants and mills.*

Figure 15.—Hardwood pulpwood being stacked at a Michigan pulp mill. Little used by pulp mills in the past, short-fibered hardwoods are now needed to satisfy the growing demand for pulpwood. The State's output of round pulpwood in 1995 is projected to be 2.7 times higher than in 1965. (Photo courtesy of Michigan Department of Natural Resources.)

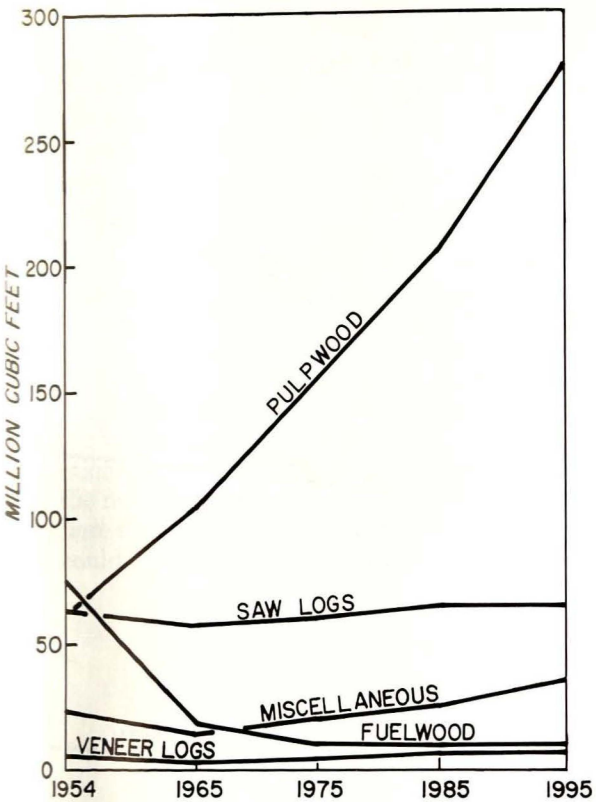


Figure 16.—Roundwood products output by major product groups in Michigan, 1954 and 1965, and projections for 1975, 1985, and 1995.

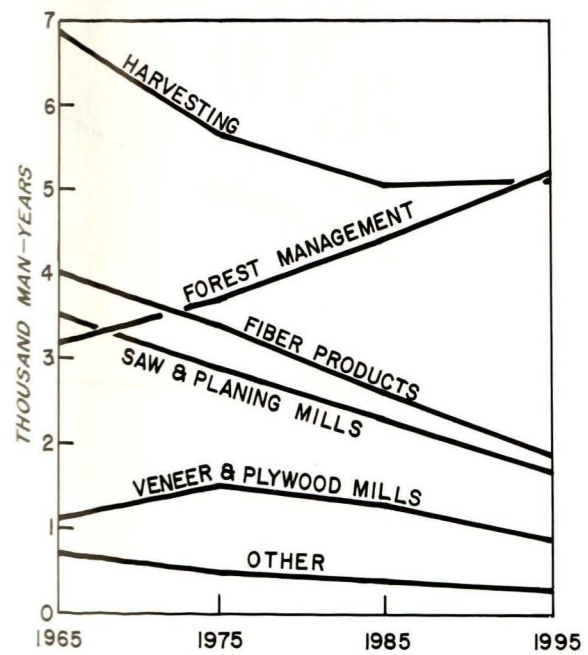


Figure 17.—Primary timber-based employment in Michigan, 1965, and projected employment in 1975, 1985, and 1995.

will require additional employment in service and related industries not reflected in the above timber-based industry estimates.

Timber-based payrolls are projected to more than double during the same 30-year period that employment is expected to drop by 22 percent. Part of the reason for this apparent contradiction is that the 1995 payroll is not in 1965 constant dollars, therefore, 1995 dollars reflect expected future inflation. However, the highly skilled employees required to run automated mills and complex harvesting equipment will receive larger salaries than the average employee of 1965.

Gap Between Timber Removals and Growth Projected to Narrow in Next 30 Years

What is likely to happen to Michigan's timber resource during the next three decades? If the changes occur that were assumed in the projection of timber products output, it is expected that removals of growing stock will increase from 206 million cubic feet in 1966 to 433 million cubic feet in 1996. This increase in the volume of trees removed will narrow the gap between net growth and timber removals. Net growth in 1965 was 2.8 times greater than removals, and by 1996 it is projected to be only 1.6 times greater than removals. Even after removals equal growth, both may be increased through timber stand improvement, genetic improvement, and fertilization. The surplus of growth over removals in the first decade of the projection period would increase the inventory rapidly – from 15.0 billion cubic feet in 1966 to 18.5 billion cubic feet in 1976. As the growth surplus declines, the growing-stock inventory will level off, and remain constant when net growth and removals are equal. For 1996 the projected inventory of growing stock is 24.4 billion cubic feet.

Softwood growing-stock removals are expected to increase at a slower rate than hardwood removals (fig. 18), largely because of the expected accelerated harvest of hardwoods for pulpwood.

The trend of projected sawtimber removals, growth, and inventory is similar to that of growing stock. Sawtimber removals in 1996 are expected to reach 1.5 billion board feet, almost double the 0.8 billion board feet in 1966. Growth on sawtimber trees will accumulate less rapidly, but should reach 2.4 billion board feet in 1996, 0.4 billion board feet more than in 1966. If the assumed removals and projected growth prove correct, Michigan's burgeoning sawtimber inventory will climb to 66.4 billion board feet in 1996.

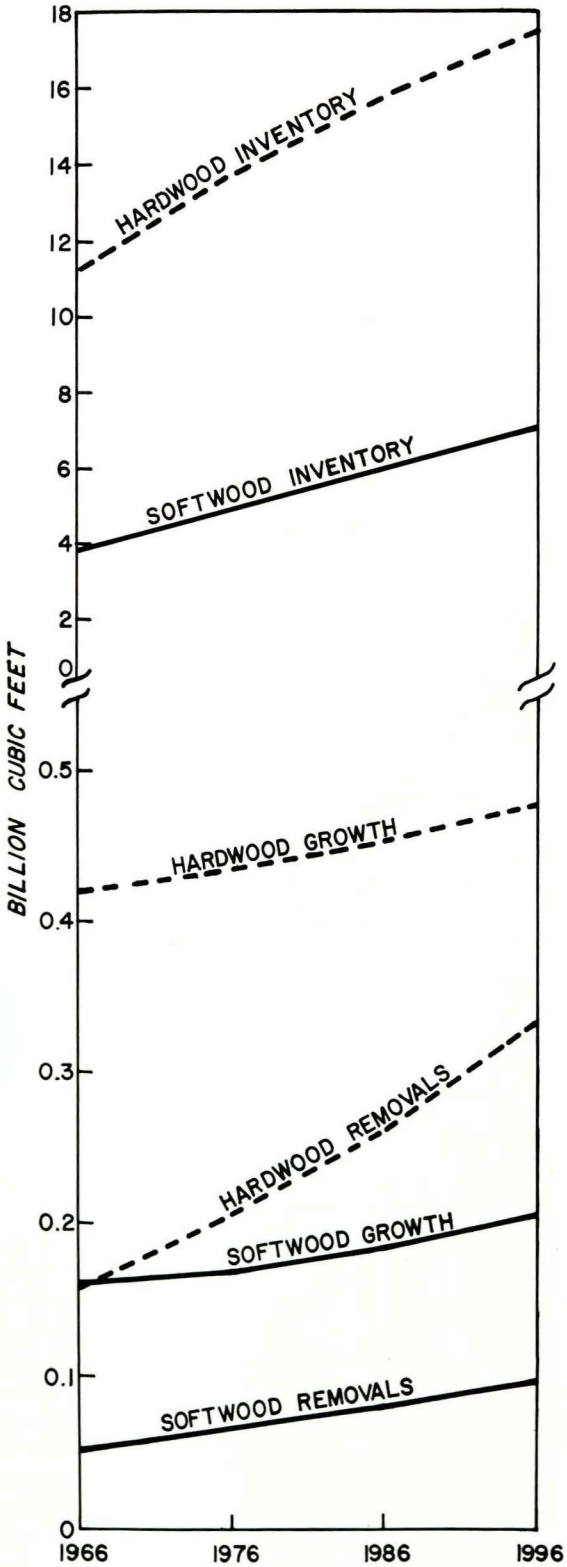


Figure 18.—Growing-stock removals, net growth, and inventory by softwoods and hardwoods, Michigan, 1966, and projections for 1976, 1986, and 1996.

This compares with the 1955 volume of 23.8 billion board feet and the 1966 figure of 33.9 billion board feet.

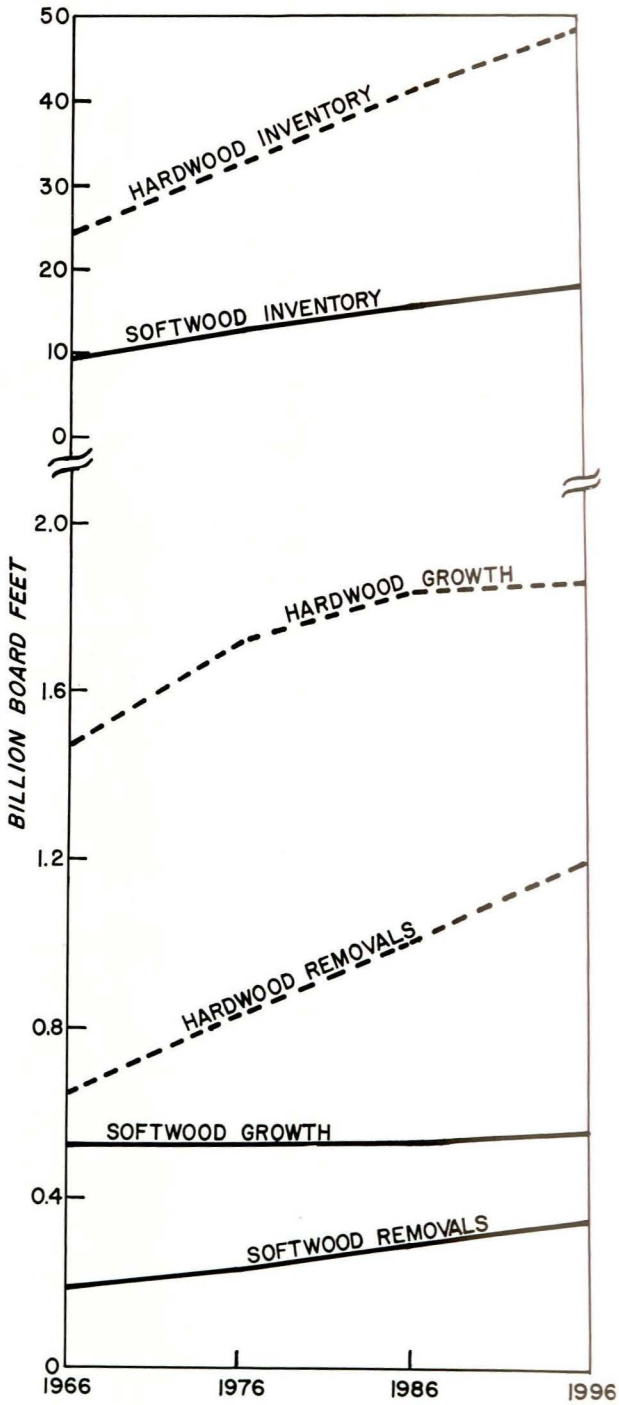


Figure 19.—Sawtimber removals, net growth, and inventory by softwoods and hardwoods, Michigan, 1966, and projections for 1976, 1986, and 1996.

Softwood sawtimber growth is projected to change little over the 30-year period (fig. 19). On the other hand, hardwood growth is expected to increase sharply and then level off at the end of the projection period.

Projections provide a long-range view that is useful in planning or managing a timber crop. The above projections provide a reasonably accurate description of the future timber resource if the assumptions on which they were based are correct. These assumptions, which are detailed in a footnote to table 49 in the Appendix, seem reasonable now but may be far off the mark by 1996. Therefore, the greatest utility of these projections is in evaluating the timber situation over the next decade.

There are a number of possible developments that could affect Michigan's future wood requirements and the role of wood in satisfying the needs of an increasing population. One such development is new equipment to permit chipping of whole trees in the woods and mechanical cutting, limbing, bucking, and stacking of pulpwood. Also, the growing importance of outdoor recreation will have an impact on the extent and methods of timber harvesting. Corporate mergers within timber-based industries will bring broader marketing control and perhaps a greater degree of stability to those engaged in providing raw materials to the industry. Opening markets overseas and competition from imports will affect the flow of timber products, but it is impossible now to judge their net effect. These and other possible innovations make the future difficult to predict, but they suggest that the future of Michigan's timber resource will be substantially different from its past.

APPENDIX

Accuracy of Survey

The forest area and timber inventory estimates in this report are based on a carefully designed sample of Michigan's forests. Since neither every acre nor every tree in the State was measured, the reported figures are best estimates. A measure of the reliability of these estimates is given by a sampling error. Following is an example of how sampling error is used.

The estimated volume of growing stock in Michigan in 1966, 15,025.0 million cubic feet, has a sampling error of ± 1.2 percent (180.3 million cubic feet). This means that if there were no errors in procedure, the odds are 2 to 1 that if we repeated the survey in the same way, the new estimate would be between 14,844.7 and 15,205.3 million cubic feet (15,025.0 ± 180.3). Similarly, the odds are 19 to 1 that it would be within ± 360.6 million cubic feet (180.3 x 2) of the present estimate.

Likewise, the sampling error for total area of commercial forest land in Michigan is ± 0.5 percent; sampling error for total sawtimber volume is ± 2.4 percent; and sampling error for total timber removals from growing stock is ± 6.5 percent.

In addition, the resource statistics are subject to human errors (mistakes in judgment, recording, calculation, and compilation). These errors are minimized through close supervision and careful training of employees and by rechecking all phases of the work.

As area, volume, growth, and cut figures are broken down by county, forest type, species, ownership, and diameter classes, sampling errors increase – the smaller the unit the higher the sampling error. The following guide may be used in approximating the sampling error for smaller units of measure (fig. 20).

Survey Procedure

Area, Volume, and Growth

In this survey a three-stage sample was used that covered the entire State except for the Ottawa National Forest. A total of 337,085 points on aerial photos were observed, of which 195,171 were classified as forest land. Of the latter, 43,548 points were stereoclassified as to

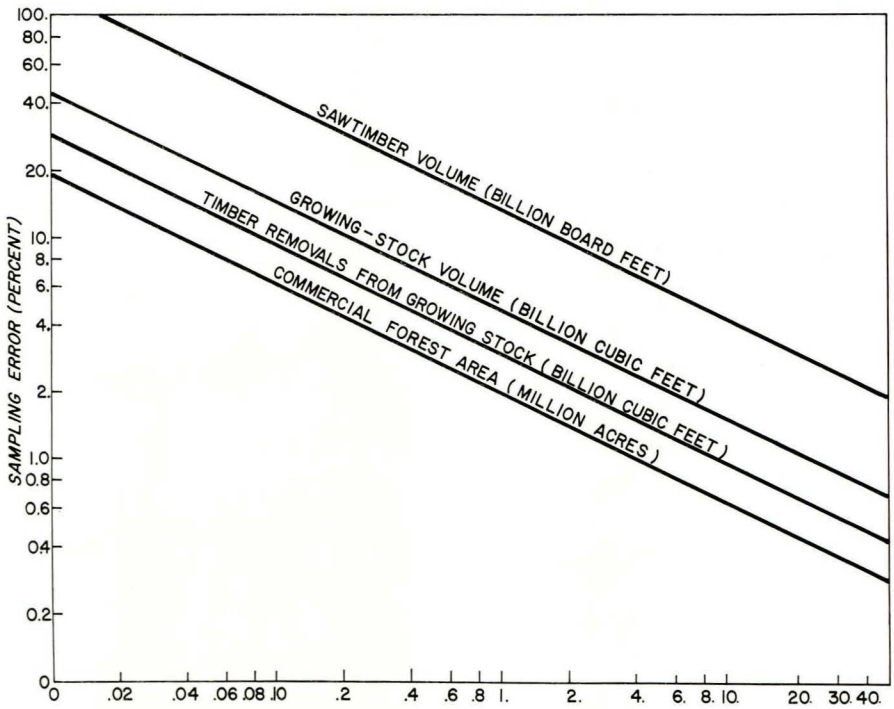


Figure 20.—Sampling errors for commercial forest area, growing-stock volume, sawtimber volume, and timber removals from growing stock, Michigan, 1966.

forest type, stand-size class, and density. A total of 3,038 points classed as forest and 3,439 points classed as nonforest were examined on the ground to correct for errors in classification and for actual changes in land use since the photos were taken. At each of the 2,772 commercial forest land locations, 10 variable-radius plots (37.5 basal area factor) were established uniformly over a sample acre. One-third of these locations were carefully marked for remeasurement during the next survey.

Growth and mortality information for the northern three-fourths of the State was obtained through remeasurement of permanent plots on State Forests, as well as from all new plots. The Michigan Department of Natural Resources remeasured 4,779 1/5-acre plots to obtain this information. In the Southern Lower Peninsula, where there are no State Forests containing permanent plots, increment borings were taken and mortality information recorded to obtain growth data.

Statistics on utilization in 1965 were obtained from mill surveys, wood utilization studies, and a tally of stumps on inventory plots. The Michigan Department of Natural Resources conducted a thorough canvass of resident sawmills, pulpmills, veneer mills, and other primary wood-using plants. The North Central Forest Experiment Station canvassed the mining industry and out-of-State sawmills, pulpmills, and veneer mills to determine their use of timber from Michigan. Fuelwood and fencepost output was based on U. S. Census of Agriculture and Housing figures, a canvass of public and industrial timber owners, and estimates of mill residues used for fuelwood determined from a canvass of Michigan primary wood-using plants. Timber cut for products was determined by a canvass of all public and industrial timber owners.

To develop wood utilization factors used in converting timber products output to timber removals by products, approximately 1,400 felled trees throughout the State were measured.

Allowable Cut

Allowable cut is the volume of timber on commercial forest land that could be cut annually for the next 10 years, while improving tree stocking and bringing about a more even distribution of age classes. It includes one-tenth of the volume in stands that would reach or exceed rotation age during the next 10 years. It also includes stand improvement cuts (partial cuts) in overstocked stands. Stands selected for harvest cuts or cultural operations had to have a yield of at least 3 cords per acre to be included in the allowable cut.

Allowable cut is based on the assumptions that all timber will be available and accessible when needed, and that a ready market will exist for every species, size, and grade of material harvested. Further, it assumes that the proper sequence of cutting is known and will be followed, and that logging practices employed will result in an improved forest. Because there is no way of guaranteeing that these assumptions will be valid over the next 10 years, the allowable cut estimates should be compared with timber removals figures only in a general way.

Definition of Terms [10]

Land-Use Classes

Gross area. – The entire area of land and water as determined by the Bureau of Census, 1960.

Land area. – The area of dry land and land temporarily or partially covered by water such as marshes, swamps, flood plains, streams, sloughs and estuaries. Canals less than 1/8 mile wide, and lakes, reservoirs, and ponds smaller than 40 acres are included as land area. These figures are from the Bureau of Census, 1960.

Forest land. – Land at least 10 percent stocked by forest trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. Includes afforested areas. The minimum forest area classified was 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, and clearings in forest areas were classed as forest if less than 120 feet in width.

Commercial forest land.—Forest land which is producing or is capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. This includes areas suitable for management to grow crops of industrial wood generally of a site quality capable of producing in excess of 20 cubic feet per acre of annual growth. This includes both accessible and inaccessible areas and both operable and currently inoperable trees.

Noncommercial forest land. – (a) Unproductive – forest land incapable of yielding crops of

10 *These are current standard definitions and are presented even though some of the classes do not occur in this report.*

industrial wood because of adverse site conditions. (b) Productive-reserved – forest land withdrawn from commercial timber use through statute or administrative regulation.

Nonforest land. – Land that has never supported forests, and land formerly forested where forest use is precluded by development for nonforest uses, such as cropland, improved pasture, residential areas, and city parks. Also includes improved roads and adjoining rights-of-way, powerline clearings, and certain areas of water classified by the Bureau of Census as land. Unimproved roads, streams, canals, and nonforest strips in forest areas must be more than 120 feet wide, and clearings in forest areas must be more than 1 acre in size, to qualify as nonforest land. "Cropland" and "pasture and range" figures were obtained from the Bureau of Census.

Ownership Classes

National Forest. – Federal lands that have been designated by Executive Order or Statute as National Forests or purchase units, and other lands under the administration of the Forest Service.

Bureau of Land Management. – Federal land administered by the Bureau of Land Management.

Indian – Tribal lands held in fee by the Federal Government but administered for Indian tribal groups and Indian trust allotments.

Miscellaneous Federal. – Federal lands other than National Forest, Bureau of Land Management, and Indian lands.

State, county, and municipal. – Lands owned by States, counties, or local public agencies, or lands leased by them for more than 50 years.

Other public. – All public lands other than National Forests.

Forest industry. – Lands owned by companies or individuals operating wood-using plants.

Pulp and paper producer. – A forest owner who manufactures woodpulp and who uses a greater cubic volume of timber from his land for this purpose than for any other primary wood product that he may produce.

Lumber producer. – A forest owner who manufactures lumber and uses a greater cubic volume of timber from his land for this purpose than for any other primary wood product that he may produce.

Farmer-owned. – Lands owned by operators of farms. A farm must include 10 or more acres from which the sale of agricultural products totals $50 or more annually or, if less than 10 acres, the yield must be at least $250 annually.

Miscellaneous private. – Privately owned lands other than forest-industry or farmer-owned.

Tree Classes

All live trees. – Growing-stock, rough, and rotten trees.

Growing-stock trees. – All live trees of any size except rough and rotten trees.

Desirable trees. – Growing-stock trees having no serious defects in quality limiting present or prospective use, and of relatively high vigor and containing no pathogens that may result in death or serious deterioration before rotation age. These are trees that would be favored by forest managers in silvicultural operations.

Acceptable trees. – Trees meeting the standards for growing stock but not qualifying as desirable trees.

Sawtimber trees. – Live trees of commercial species containing at least a 12-foot saw log. Softwoods must be at least 9.0 inches in diameter at breast height and hardwoods at least 11.0 inches.

Poletimber trees. – Live trees of commercial species at least 5.0 inches in diameter at breast height but smaller than sawtimber size, and of good form and vigor.

Saplings. – Live trees of commercial species 1.0 to 5.0 inches in diameter at breast height and of good form and vigor.

Seedlings. – Live trees of commercial species less than 1.0 inch in diameter at breast height that are expected to survive according to regional standards. (Examples of seedlings not expected to survive are those that are diseased or heavily damaged by logging, browsing, or fire.) Only softwood seedlings over 6 inches and hardwood seedlings over 1 foot in height are counted.

Rotten trees. – Live trees of commercial species that do not contain a merchantable 12-foot saw log, now or prospectively, because of rot (that is, when more than 50 percent of the cull volume of the tree is rotten).

Rough trees. – Live trees that do not contain at least one merchantable 12-foot saw log, now or prospectively, because of roughness, poor form, or noncommercial species.

Short-log trees (rough trees). – Trees that contain one or more 8- to 11-foot saw logs and which would qualify as sawtimber trees except for the 12-foot saw log length requirement.

Stocking

The degree of utilization of land by trees as measured in terms of basal area and/or the number of trees required to utilize fully the

growth potential of the land. The actual stocking at a point was evaluated against the stocking standard for that specific forest type in square feet of basal area per acre for trees 5.0 inches in diameter at breast height and larger, or its equivalent in numbers of trees per acre for seedlings and saplings. Actual stocking is expressed as a percent of the stocking required to utilize fully the growth potential of the land and is grouped into stocking classes.

Stocking Classes

Well-stocked stands. – Stands 70 percent or more stocked with growing-stock trees.

Medium-stocked stands. – Stands 40 to 69 percent stocked with growing-stock trees.

Lightly stocked stands. – Stands 10 to 39 percent stocked with growing-stock trees.

Stand-Size Classes

Sawtimber stands. – Stands at least 10 per cent stocked with growing-stock trees, with half or more of this stocking in sawtimber or poletimber trees and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands. – Stands at least 10 percent stocked with growing-stock trees, and with half or more of this stocking in sawtimber and/or poletimber trees and with poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands. – Stands at least 10 percent stocked with growing-stock trees and with saplings and/or seedlings comprising more than half of this stocking.

Nonstocked areas. – Commercial forest land less than 10 percent stocked with growing-stock trees.

Area-Condition Classes

Excellent. – Areas 70 percent or more stocked with desirable trees.

Good. – Areas 40 to 70 percent stocked with desirable trees and on which less than 30 percent of the area is controlled by other trees and/or inhibiting vegetation or surface conditions that will prevent occupancy by desirable trees.

Favorable. – Areas 40 to 70 percent stocked with desirable trees and on which 30 percent or more of the area is controlled by other trees and/or inhibiting vegetation or conditions that will prevent occupancy by desirable trees.

Moderately favorable. – Areas less than 40 percent stocked with desirable trees but with 70 percent or more of the area occupied by growing-stock trees.

Fair. – Areas less than 40 percent stocked with desirable trees but with 40 to 70 percent of the area occupied by growing-stock trees.

Unfavorable. – Areas less than 40 percent stocked with desirable trees and with less than 40 percent of the area occupied by growing-stock trees.

Other Land Classifications

Site index. – An expression of forest site quality based on the height of a free-growing dominant or codominant tree of a representative species in the forest type at age 50.

Site classes. – A classification of forest land in terms of inherent capacity to grow crops of industrial wood expressed in cubic-foot growth per acre per year.

Stand-age. – Age of the main stand for both even and uneven-aged stands. Main stand refers to trees of the dominant forest type and stand-size class.

Forest Types

A classification of forest land based upon the species forming a plurality of live-tree stocking. Major forest types in Michigan are:

White-red-jack pine. – Forests in which eastern white pine, red pine, jack pine, or scotch pine, singly or in combination, comprise a plurality of the stocking of live trees. These forests may be subtyped as white pine, red pine, jack pine, or scotch pine depending on which species is most common.

Spruce-fir. – Forests in which spruce or true firs, singly or in combination, comprise a plurality of the stocking. These forests may be subtyped as balsam fir - white spruce, black spruce, northern white-cedar, or tamarack depending on which species is most common.

Oak-hickory. – Forests in which upland oaks or hickories, singly or in combination, comprise a plurality of the stocking. Common associates include jack pine, beech, yellow-poplar, elm, maple, and black walnut

Elm-ash-cottonwood. – Forests in which elm, ash, or cottonwood, singly or in combination, comprise a plurality of the stocking. Common associates include willow, sycamore, and maple. These forests may be subtyped cottonwood when it is the most common species.

Maple-beech-birch. – Forests in which maple, beech, or yellow birch, singly or in combination, comprise a plurality of the stocking. Common

associates include hemlock, elm, basswood, and white pine. Locally this type is called "northern hardwoods."

Aspen-birch. – Forests in which quaking or bigtooth aspen, balsam poplar, or paper birch, singly or in combination, comprise a plurality of the stocking. Common associates include maple and balsam fir. These forests may be subtyped paper birch when it is the most common species.

Timber Volume

Volume of growing stock. – The volume of sound wood in the bole of sawtimber and poletimber trees from stump to a minimum of 4.0-inch top diameter outside bark, or to the point where the central stem breaks into limbs. Growing-stock volumes are shown in cubic feet but may be converted into solid-wood cords by dividing by 79.

Volume of sawtimber. – Net volume of the saw-log portion of live sawtimber trees in board feet, International ¼-inch rule, from stump to a minimum 7 inches top diameter outside bark for softwoods and 9 inches for hardwoods.

Upper stem portion. – That part of the bole of sawtimber trees above the merchantable top to a minimum top diameter of 4.0 inches outside bark or to the point where the central stem breaks into limbs.

Quality Classes

Log grade. – Classification of logs based on external characteristics as indicators of quality. Hardwood species were graded in accordance with "Hardwood Log Grades for Standard Lumber," issued by the Forest Products Laboratory under the designation D 1737, 1953, and U.S.D.A. Forest Service standards for hardwood tie and timber logs. The best 12-foot section of the lowest 16-foot hardwood log, or the best 12-foot upper section if the but log did not meet minimum log-grade standards was graded.

Red pine was graded in accordance with "Interim Southern Pine Log Grades," U.S.D.A. Forest Service, 1953. Eastern white pine was graded in accordance with U.S.D.A. Forest Service "Log Grades for Eastern White Pine." All other softwoods were graded according to "Specifications for Log Grades of Hardwoods and Softwoods," Northern Hemlock and Hardwood Association, 1947. The lowest 16-foot log in softwood trees or a shorter log down to 12 feet if a 16-foot butt log was not present was graded.

Growth

Net annual growth of growing stock. – The annual change in volume of sound wood in live sawtimber and poletimber trees and the total volume of trees entering these classes through ingrowth, less volume losses resulting from natural causes.

Net annual growth of sawtimber. – The annual change in volume of live sawtimber trees and the total volume of trees reaching sawtimber size, less volume losses resulting from natural causes.

Mortality of growing stock. – The volume of sound wood in live sawtimber and poletimber trees dying annually from natural causes. Natural causes include fire, insects, disease, animal damage, weather, and suppression.

Mortality of sawtimber. – The net board-foot volume of sawtimber trees dying annually from natural causes.

Timber Removals

Timber removals from growing stock. – The volume of sound wood in live sawtimber and poletimber trees harvested annually for forest products, including roundwood products, logging residues, and other removals. Roundwood products are logs, bolts, or other round sections cut from trees. Logging residues are the unused portions of cut trees plus unused trees killed by logging. Other removals are growing-stock trees removed by cultural operations such as timber stand improvement work, and by land clearing and changes in land use.

Timber removals from sawtimber. – The net board-foot volume of live sawtimber trees cut for forest products annually, including roundwood products, logging residues, and other removals.

Timber products output. – All timber products cut from roundwood, and byproducts of wood-manufacturing plants. Roundwood products include logs, bolts, or other round sections cut from growing-stock trees, cull trees, salvable dead trees, trees on nonforest land, noncommercial species, sapling-size trees, and limbwood. Byproducts from primary manufacturing plants include slabs, edgings, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and screenings of pulpmills. The annual timber cut includes roundwood products and logging residues but does not include output from non-growing stock or plant byproducts.

Principal Tree Species in Michigan [11]

SOFTWOOD SPECIES

White and red pines:	
Eastern white pine	*Pinus strobus*
Red pine	*Pinus resinosa*
Jack pine	*Pinus banksiana*
Spruce and balsam fir:	
White spruce	*Picea glauca*
Black spruce	*Picea mariana*
Balsam fir	*Abies balsamea*
Eastern hemlock	*Tsuga canadensis*
Other eastern softwoods:	
Tamarack	*Larix laricina*
Northern white-cedar	*Thuja occidentalis*
Other softwoods:	
Scotch pine	*Pinus sylvestris*
Eastern redcedar	*Juniperus virginiana*

HARDWOOD SPECIES

Select white oaks:	
White oak	*Quercus alba*
Bur oak	*Quercus macrocarpa*
Chinkapin oak	*Quercus muehlenbergii*
Swamp white oak	*Quercus bicolor*
Select red oaks:	
Northern red oak	*Quercus rubra*
Other red oaks:	
Black oak	*Quercus velutina*
Pin oak	*Quercus palustris*
Hickory:	
Bitternut hickory	*Carya cordiformis*
Pignut hickory	*Carya glabra*
Shagbark hickory	*Carya ovata*
Yellow birch	*Betula alleghaniensis*
Hard maple:	
Black maple	*Acer nigrum*
Sugar maple	*Acer saccharum*
Soft maple:	
Red maple	*Acer rubrum*
Silver maple	*Acer saccharinum*
American beech	*Fagus grandifolia*
Ash:	
Black ash	*Fraxinus nigra*
White ash	*Fraxinus americana*
Cottonwood and aspen:	
Balsam poplar	*Populus balsamifera*
Bigtooth aspen	*Populus grandidentata*
Quaking aspen	*Populus tremuloides*
Eastern cottonwood	*Populus deltoides*
American basswood	*Tilia americana*
Yellow-poplar	*Liriodendron tulipifera*
Black walnut	*Juglans nigra*
Other eastern hardwoods:	
Black cherry	*Prunus serotina*
American elm	*Ulmus americana*
Rock elm	*Ulmus thomasii*
Slippery elm	*Ulmus rubra*
Paper birch	*Betula papyrifera*
Other hardwoods:	
Hackberry	*Celtis occidentalis*
American sycamore	*Platanus occidentalis*
Butternut	*Juglalns cinerea*
Red mulberry	*Morus rubra*
Blackgum	*Nyssa sylvatica*
Black willow	*Salix nigra*
Boxelder	*Acer negundo*
Honeylocust	*Gleditsia triancanthos*
Black locust	*Robinia pseudoacacia*
Sassafras	*Sassafras albidum*

11 *The common and scientific names are based on "Check List of Native and Naturalized Trees of the United States (Including Alaska)" by Elbert L. Little, Jr., U. S. Dep. Agr., Agr. Handb. 41, 472 p. 1953.*

Tables [12]

Text Tables:

1. Net volume of growing stock on commercial forest land by species group and percentage of total vollume (see page 4)
2. Net volume of sawtimber on commercial forest land by species group and percentage of total volume (see page 4)
3. Volume of growing-stock gross growth, mortality, and net growth for selected species (see page 5)
4. Volume of sawtimber gross growth, mortality, and net growth for selected species (see page 6)
5. Area of commercial forest land by stand-size class in Michigan, 1935, 1955, and 1966 (see page 11)
6. Volume of growing stock and sawtimber underutilized and overutilized by species (see page 13)

Area:

7. Area by land class and Forest Survey Unit
8. Area of commercial forest land, by ownership class and Forest Survey Unit
9. Area of commercial forest land, by stand-size and ownership class, and Forest Survey Unit
10. Area of commercial forest land, by stand-volume and ownership class
11. Area of commercial forest land, by stocking class based on selected stand components
12. Area of commercial forest land, by area-condition and ownership class
13. Area of commercial forest land, by site and ownership class
14. Area of commercial forest land, by forest type and ownership class
15. Area of noncommercial forest land, by forest type
16. Area of land and forest land, by county
17. Area of commercial forest land, by forest type, stand-size class, and Forest Survey Unit
18. Area of commercial forest land, by forest type and stand-age class
19. Area of commercial forest land, by forest type and area-condition class
20. Area of commercial forest land, by forest type and site-index class
21. Area of commercial forest land, by stocking class of growing-stock trees and stand-size class

Number of Trees:

22. Number of growing-stock trees on commercial forest land, by species and diameter class
23. Number of growing-stock trees on commercial forest land, by diameter class, softwoods and hardwoods, and Forest Survey Unit
24. Percentage of sawtimber trees on commercial forest land, by butt-log grade and species

Volume:

25. Net volume of timber on commercial forest land, by timber class and by softwoods and hardwoods
26. Net volume of growing stock and sawtimber on commercial forest land, by ownership class and by softwoods and hardwoods
27. Net volume of growing stock on commercial forest land, by species and diameter class
28. Net volume of sawtimber on commercial forest land, by species and diameter class
29. Net volume of growing stock on commercial forest land, by species and Forest Survey Unit
30. Net volume of sawtimber on commercial forest land, by species and Forest Survey Unit
31. Net volume of growing stock and sawtimber on commercial forest land, by county and by softwoods and hardwoods

Growth and Removals:

32. Net annual growth and removals of growing stock and sawtimber on commercial forest land, by species
33. Net annual growth and removals of growing stock and sawtimber on commercial forest land, by ownership class and by softwoods and hardwoods
34. Net annual growth of growing stock on commercial forest land, by species and Forest Survey Unit

---

12 *Tables containing growth, mortality, removals, and forest industry information are dated 1965. Tables containing forest area and timber inventory information are dated 1966 and represent conditions as of January 1, 1966, following changes to the area and inventory estimated to have occurred during calendar year 1965.*

35. Net annual growth of sawtimber on commercial forest land, by species and Forest Survey Unit

36. Timber removals from growing stock on commercial forest land, by item and species group

37. Timber removals from live sawtimber on commercial forest land, by item and species group.

38. Timber removals from growing stock on commercial forest land, by species and Forest Survey Unit

39. Timber removals from live sawtimber on commercial forest land, by species and Forest Survey Unit

Mortality:

40. Mortality of growing stock and sawtimber on commercial forest land, by species

41. Mortality of growing stock and sawtimber on commercial forest land, by ownership class and by softwoods and hardwoods

42. Mortality of growing stock and sawtimber on commercial forest land, by cause and by softwoods and hardwoods

Utilization:

43. Output of timber products, by source of material and by softwoods and hardwoods

44. Output of roundwood products, by source and by softwoods and hardwoods

45. A comparison of the number of primary wood-using plants operating in 1954 and 1965, by Forest Survey Unit

46. Volume of unused residues at primary manufacturing plants, by industry, type of residue, and by softwoods and hardwoods

47. Value of timber products to producer, by Forest Survey Unit

Allowable Cut:

48. Annual allowable cut of growing stock on commercial forest land, by species and Forest Survey Unit

49. Annual allowable cut of live sawtimber on commercial forest land, by species and Forest Survey Unit

Projections:

50. Removals, net annual growth, and inventory of growing stock and sawtimber on commercial forest land, Michigan, 1966, and projections to 1996

51. Timber products output in Michigan, 1965, and projections to 1995

52. Timber-based employment in Michigan, 1965, and projections to 1995

53. Timber-based payrolls in Michigan, 1965, and projections to 1995

Table 7.—Area by land class and Forest Survey Unit, Michigan, 1966

(In thousands of acres)

Land class	All units	Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
Forest land:					
Commercial	18,900.2	4,169.1	4,920.9	6,994.0	2,816.2
Unproductive	205.0	79.5	77.0	34.5	14.0
Productive-reserved	268.2	32.7	185.4	23.2	26.9
Total	19,373.4	4,281.3	5,183.3	7,051.7	2,857.1
Nonforest land:					
Cropland 1/	6,738.0	166.1	80.4	1,169.4	5,322.1
Pasture and range	1,781.2	94.1	48.1	572.4	1,066.6
Other 2/	8,599.5	471.1	260.0	2,593.9	5,274.5
Total	17,118.7	731.3	388.5	4,335.7	11,663.2
All area 3/	36,492.1	5,012.6	5,571.8	11,387.4	14,520.3

1/ Source: 1964 Census of Agriculture.

2/ Includes marshland and open bog, industrial and urban areas, other nonforest land, and 148,800 acres classed as water by Forest Survey standards, but defined by the Bureau of the Census as land.

3/ Source: United States Bureau of the Census, Land and Water Area of the United States, 1960.

Table 8.—Area of commercial forest land, by ownership class and Forest Survey Unit, Michigan, 1966
(In thousands of acres)

Ownership class	All Units	Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
National Forest	2,422.8	736.4	837.0	840.4	9.0
Other Federal:					
Bureau of Land Management	8.4	4.1	2.8	1.5	--
Indian	17.4	4.5	12.5	.4	--
Miscellaneous Federal	45.1	38.3	1.0	--	5.8
Total other Federal	70.9	46.9	16.3	1.9	5.8
State Forest	3,635.4	1,085.4	660.1	1,889.9	--
Other State	202.6	5.8	5.5	37.6	153.7
County and municipal	108.7	2.6	71.3	16.4	18.4
Forest industry 1/	2,256.7	784.9	1,367.2	72.8	31.8
Farmer	3,530.4	483.0	330.5	1,045.4	1,671.5
Miscellaneous private	6,672.7	1,024.1	1,633.0	3,089.6	926.0
All ownership	18,900.2	4,169.1	4,920.9	6,994.0	2,816.2

1/ Not including 31.9 thousand acres of farmer-owned and miscellaneous private lands leased to forest industry.

Table 9.—Area of commercial forest land, by stand-size and ownership class, and Forest Survey Unit, Michigan, 1966
(In thousands of acres)

Stand-size class	All ownerships	National Forest	State Forest	Other public	Forest industry	Farmer and miscellaneous private
Sawtimber	4,723.2	378.7	906.1	144.1	940.5	2,353.8
Poletimber	8,205.8	1,223.3	1,663.7	134.5	745.9	4,438.4
Sapling and seedling	5,432.8	761.8	987.6	90.0	562.6	3,030.8
Nonstocked areas	538.4	59.0	78.0	13.6	7.7	380.1
All classes	18,900.2	2,422.8	3,635.4	382.2	2,256.7	10,203.1
EASTERN UPPER PENINSULA						
Sawtimber	1,039.5	137.0	288.6	31.6	304.4	277.9
Poletimber	1,800.4	375.4	456.2	14.2	248.1	706.5
Sapling and seedling	1,291.3	224.0	333.5	5.2	224.7	503.9
Nonstocked areas	37.9	--	7.1	4.3	7.7	18.8
All classes	4,169.1	736.4	1,085.4	55.3	784.9	1,507.1
WESTERN UPPER PENINSULA						
Sawtimber	1,559.5	210.4	277.5	33.5	601.6	436.5
Poletimber	2,157.0	443.2	249.8	40.0	451.2	972.8
Sapling and seedling	1,134.8	147.0	105.9	19.6	314.4	547.9
Nonstocked areas	69.6	36.4	26.9	--	--	6.3
All classes	4,920.9	837.0	660.1	93.1	1,367.2	1,963.5
NORTHERN LOWER PENINSULA						
Sawtimber	1,220.3	30.4	340.0	11.8	5.9	832.2
Poletimber	3,568.6	401.6	957.7	27.4	46.6	2,135.3
Sapling and seedling	2,036.3	386.8	548.2	16.7	20.3	1,064.3
Nonstocked areas	168.8	21.6	44.0	--	--	103.2
All classes	6,994.0	840.4	1,889.9	55.9	72.8	4,135.0
SOUTHERN LOWER PENINSULA						
Sawtimber	903.9	.9	--	67.2	28.6	807.2
Poletimber	679.8	3.1	--	52.9	--	623.8
Sapling and seedling	970.4	4.0	--	48.5	3.2	914.7
Nonstocked areas	262.1	1.0	--	9.3	--	251.8
All classes	2,816.2	9.0	--	177.9	31.8	2,597.5

Table 10.—Area of commercial forest land, by stand-volume [1] *and ownership class, Michigan, 1966*
(In thousands of acres)

Stand volume per acre (board feet) [2]	All ownerships	National Forest	State Forest	Other public	Forest industry	Farmer and miscellaneous private
Less than 1,500	11,648.9	1,460.3	2,304.9	242.3	1,232.8	6,408.6
1,500 to 5,000	5,092.1	673.6	945.5	99.4	696.0	2,677.6
More than 5,000	2,159.2	288.9	385.0	40.5	327.9	1,116.9
All classes	18,900.2	2,422.8	3,635.4	382.2	2,256.7	10,203.1

1/ Sawtimber trees only.
2/ International 1/4-inch rule.

Table 11.—Area of commercial forest land, by stocking class based on selected stand components, Michigan, 1966
(In thousands of acres)

Stocking percentage	Stocking classified in terms of--		
	All trees	Growing-stock trees	Desirable trees
100+	5,048.8	2,169.6	11.5
90 - 100	3,019.5	2,173.5	4.7
80 - 90	2,733.1	2,458.6	36.7
70 - 80	2,377.2	2,756.2	107.2
60 - 70	1,759.7	2,514.3	145.4
50 - 60	1,159.6	1,757.9	457.3
40 - 50	959.4	1,487.8	918.7
30 - 40	740.1	1,329.9	1,761.7
20 - 30	552.0	1,028.8	2,844.7
10 - 20	387.8	685.2	4,151.2
Less than 10	163.0	538.4	8,461.1
Total	18,900.2	18,900.2	18,900.2

Table 12.—Area of commercial forest land, by area-condition and ownership class, Michigan, 1966
(In thousands of acres)

Area-condition class	All ownerships	National Forest	State Forest	Other public	Forest industry	Farmer and miscellaneous private
Excellent: Fully stocked with desirable trees and not overstocked.	162.7	19.7	61.8	6.5	7.1	67.6
Good: Fully stocked with desirable trees, but overstocked with all live trees.	186.9	13.1	45.8	4.8	28.7	94.5
Favorable: Medium to fully stocked with desirable trees and with less than 30 percent of the area controlled by other trees and/or inhibiting vegetation or surface conditions that will prevent occupancy by desirable trees.	1,348.8	114.8	270.4	28.4	132.0	803.2
Moderately favorable: Medium to fully stocked with desirable trees and with 30 percent or more of the area controlled by other trees and/or conditions that ordinarily prevent occupancy by desirable trees.	8,303.8	1,195.7	1,492.2	156.9	1,336.2	4,122.8
Fair: Poorly stocked with desirable trees, but fully stocked with growing-stock trees.	5,575.2	807.4	1,089.5	114.6	623.1	2,940.6
Unfavorable: Poorly stocked with desirable trees, and with medium or poor stocking of growing-stock trees.	3,322.8	272.1	675.7	71.0	129.6	2,174.4
All classes	18,900.2	2,422.8	3,635.4	382.2	2,256.7	10,203.1

Table 13.—Area of commercial forest land, by site and ownership class, Michigan, 1966
(In thousands of acres)

Site class (cubic feet of growth per acre per year)	All ownership	National Forest	State Forest	Other public	Forest industry	Farmer and miscellaneous private
120 or more	242.2	25.3	46.1	4.9	21.2	144.7
85 - 120	1,797.0	167.0	334.5	35.2	136.7	1,123.6
50 - 85	5,703.8	542.5	1,128.2	118.6	469.1	3,445.4
Less than 50	11,157.2	1,688.0	2,126.6	223.5	1,629.7	5,489.4
All classes	18,900.2	2,422.8	3,635.4	382.2	2,256.7	10,203.1

Table 14.—Area of commercial forest land, by forest type and ownership class, Michigan, 1966
(In thousands of acres)

Forest type	All ownerships	Public	Private
White-red-jack pine	1,765.7	1,398.4	367.3
Spruce-fir	2,873.5	1,110.2	1,763.3
Oak-hickory	2,405.0	605.9	1,799.1
Elm-ash-cottonwood	1,936.0	283.9	1,652.1
Maple-beech-birch	5,244.5	1,239.4	4,005.1
Aspen-birch	4,675.5	1,802.6	2,872.9
All types	18,900.2	6,440.4	12,459.8

Table 15. —Area of noncommercial forest land, by forest type, Michigan, 1966
(In thousands of acres)

Forest type	All areas	Productive-reserved	Unproductive
White-red-jack pine	31.7	8.2	23.5
Spruce-fir	203.0	74.8	128.2
Oak-hickory	19.0	19.0	--
Elm-ash-cottonwood	48.3	16.5	31.8
Maple-beech-birch	87.6	87.6	--
Aspen-birch	83.6	62.1	21.5
All types	473.2	268.2	205.0

Table 16.—Area of land and forest land, by county, Michigan, 1966

County	All [1/] land	Forest land			Commerical forest as a percent of land area
		All forest	Non-commercial	Commercial	
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Percent
Alcona	433.3	324.1	1.3	322.8	74.5
Alger	584.3	540.6	4.7	535.9	91.7
Allegan	530.6	150.7	.6	150.1	28.3
Alpena	363.5	212.2	1.8	210.4	57.9
Antrim	305.3	186.4	.8	185.6	60.8
Arenac	235.5	106.4	1.0	105.4	44.8
Baraga	578.6	543.3	8.2	535.1	92.5
Barry	351.4	94.4	.8	93.6	26.6
Bay	285.4	48.3	.6	47.7	16.7
Benzie	202.2	124.7	2.7	122.0	60.3
Berrien	371.2	71.0	1.6	69.4	18.7
Branch	323.8	56.6	.2	56.4	17.4
Calhoun	453.8	99.7	.7	99.0	21.8
Cass	312.3	69.7	.3	69.4	22.2
Charlevoix	265.0	162.6	.9	161.7	61.0
Cheboygan	464.0	340.3	3.1	337.2	72.7
Chippewa	1,011.2	805.1	38.6	766.5	75.8
Clare	366.1	230.3	1.3	229.0	62.6
Clinton	365.4	45.0	--	45.0	12.3
Crawford	360.3	313.6	10.0	303.6	84.3
Delta	755.2	638.3	14.4	623.9	82.6
Dickinson	484.5	454.0	6.3	447.7	92.4
Eaton	362.9	55.9	.1	55.8	15.4
Emmet	295.0	189.4	6.7	182.7	61.9
Genesee	411.5	56.2	.2	56.0	13.6
Gladwin	321.9	189.7	2.8	186.9	58.1
Gogebic	711.7	666.4	22.3	644.1	90.5
Grand Traverse	297.0	161.7	.6	161.1	54.2
Gratiot	362.2	49.4	--	49.4	13.6
Hillsdale	384.6	70.3	.3	70.0	18.2
Houghton	659.2	576.9	16.1	560.8	85.1
Huron	526.1	62.7	1.1	61.6	11.7
Ingham	357.8	58.6	.3	58.3	16.3
Ionia	368.0	63.5	.1	63.4	17.2
Iosco	350.1	243.9	1.7	242.2	69.2
Iron	766.1	708.7	12.6	696.1	90.9
Isabella	366.1	97.9	.8	97.1	26.5
Jackson	451.2	96.2	.5	95.7	21.2
Kalamazoo	362.9	79.9	1.4	78.5	21.6
Kalkaska	361.0	271.1	.4	270.7	75.0
Kent	551.7	129.3	.6	128.7	23.3
Keweenaw	348.2	341.2	128.5	212.7	61.1
Lake	366.1	297.1	.2	296.9	81.1
Lapeer	420.5	83.8	3.8	80.0	19.0
Leelanau	223.4	114.2	1.0	113.2	50.7

(Continued on next page)

Table 16 continued

County	All 1/ land	Forest land			Commercial forest as a percent of land area
		All forest	Non-commercial	Commercial	
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Percent
Lenawee	482.5	64.8	.9	63.9	13.2
Livingston	365.4	92.5	.7	91.8	25.1
Luce	585.0	543.3	17.1	526.2	89.9
Mackinac	649.0	572.0	10.1	561.9	86.6
Macomb	307.8	46.5	1.5	45.0	14.6
Manistee	357.1	221.3	1.1	220.2	61.7
Marquette	1,178.2	1,108.6	11.5	1,097.1	93.1
Mason	315.5	160.1	1.5	158.6	50.3
Mecosta	360.3	149.6	1.2	148.4	41.2
Menominee	660.5	527.5	14.2	513.3	77.7
Midland	332.8	171.7	1.6	170.1	51.1
Missaukee	361.6	227.4	.3	227.1	62.8
Monroe	359.7	35.1	.1	35.0	9.7
Montcalm	455.7	134.4	.7	133.7	29.3
Montmorency	355.2	287.5	.5	287.0	80.8
Muskegon	322.6	170.0	1.0	169.0	52.4
Newaygo	548.5	311.7	1.5	310.2	56.6
Oakland	561.3	154.6	17.4	137.2	24.4
Oceana	343.0	152.3	2.1	150.2	43.8
Ogemaw	367.4	241.4	1.9	239.5	65.2
Ontonagon	845.3	784.2	56.9	727.3	86.0
Osceola	371.8	176.1	1.4	174.7	47.0
Oscoda	361.6	302.3	1.0	301.3	83.3
Otsego	339.2	251.8	.8	251.0	74.0
Ottawa	361.0	89.1	.7	88.4	24.5
Presque Isle	418.5	290.8	1.6	289.2	69.1
Roscommon	333.4	271.9	2.0	269.9	81.0
Saginaw	519.7	99.0	.3	98.7	19.0
St. Clair	473.6	79.4	.9	78.5	16.6
St. Joseph	325.1	57.7	.5	57.2	17.6
Sanilac	615.0	70.4	.2	70.2	11.4
Schoolcraft	767.4	654.5	13.1	641.4	83.6
Shiawassee	345.6	42.5	--	42.5	12.3
Tuscola	522.2	105.7	.2	105.5	20.2
Van Buren	388.5	100.1	.5	99.6	25.6
Washtenaw	458.2	84.2	1.1	83.1	18.1
Wayne	388.5	38.2	1.6	36.6	9.4
Wexford	360.3	221.9	1.5	220.4	61.2
State total	36,492.1	19,373.4	473.2	18,900.2	51.8

1/ From U.S. Bureau of the Census, Land and Water Area of the United States, 1966.

Table 17.—Area of commercial forest land, by forest type, stand-size class, and Forest Survey Unit, Michigan, 1966
(In thousands of acres)

ALL UNITS

Forest type	All stands	Saw-timber stands	Pole-timber stands	Sapling and seedling stands	Non-stocked areas
White-red-jack pine:					
Jack pine	896.7	107.7	454.1	323.3	11.6
Red pine	596.5	130.3	148.9	315.6	1.7
White pine	154.3	118.6	9.6	19.7	6.4
Scotch pine	118.2	--	4.3	113.9	--
Spruce-fir:					
Balsam fir-white spruce	1,081.7	141.2	585.3	354.7	.5
Black spruce	428.1	33.8	130.9	256.4	7.0
Northern white-cedar	1,187.7	303.2	535.6	321.7	27.2
Tamarack	176.0	10.9	36.2	115.7	13.2
Oak-hickory	2,405.0	725.7	1,035.1	512.4	131.8
Elm-ash-cottonwood	1,936.0	572.6	733.8	474.7	154.9
Maple-beech-birch	5,244.5	2,181.0	2,149.2	873.0	41.3
Aspen-birch:					
Aspen	4,259.0	345.3	2,145.0	1,638.5	130.2
Paper birch	416.5	52.9	237.8	113.2	12.6
All types	18,900.2	4,723.2	8,205.8	5,432.8	538.4
EASTERN UPPER PENINSULA					
White-red-jack pine:					
Jack pine	276.2	56.7	127.6	91.9	--
Red pine	173.8	53.1	37.7	83.0	--
White pine	22.7	18.8	3.9	--	--
Spruce-fir:					
Balsam fir-white spruce	393.1	33.0	234.4	125.7	--
Black spruce	229.1	15.7	42.4	166.8	4.2
Northern white-cedar	566.8	148.1	235.5	183.2	--
Tamarack	70.4	5.0	14.2	51.2	--
Oak-hickory	19.8	--	19.8	--	--
Elm-ash-cottonwood	338.7	102.1	184.4	41.2	11.0
Maple-beech-birch	1,204.5	543.2	478.3	177.6	5.4
Aspen-birch:					
Aspen	776.2	63.8	354.5	340.6	17.3
Paper birch	97.8	--	67.7	30.1	--
All types	4,169.1	1,039.5	1,800.4	1,291.3	37.9
WESTERN UPPER PENINSULA					
White-red-jack pine:					
Jack pine	136.1	16.1	68.9	42.9	8.2
Red pine	61.1	25.6	4.7	29.1	1.7
White pine	71.0	57.1	5.7	8.1	.1
Spruce-fir:					
Balsam fir-white spruce	479.5	99.5	214.6	164.9	.5
Black spruce	169.6	18.1	75.2	73.5	2.8
Northern white-cedar	277.0	63.9	130.3	61.1	21.7
Tamarack	44.8	--	2.1	40.0	2.7
Oak-hickory	72.6	3.3	58.5	10.8	--
Elm-ash-cottonwood	247.4	91.8	108.9	44.9	1.8
Maple-beech-birch	2,225.0	1,070.1	802.2	351.2	1.5
Aspen-birch:					
Aspen	1,015.8	98.1	613.8	275.3	28.6
Paper birch	121.0	15.9	72.1	33.0	--
All types	4,920.9	1,559.5	2,157.0	1,134.8	69.6

(Continued on next page)

Table 17 continued

NORTHERN LOWER PENINSULA

Forest type	All stands	Saw-timber stands	Pole-timber stands	Sapling and seedling stands	Non-stocked areas
White-red-jack pine:					
Jack pine	472.1	34.9	256.0	177.8	3.4
Red pine	325.1	37.4	89.9	197.8	--
White pine	43.0	36.7	--	--	6.3
Scotch pine	82.0	--	--	82.0	--
Spruce-fir:					
Balsam fir-white spruce	193.0	8.7	136.3	48.0	--
Black spruce	29.4	--	13.3	16.1	--
Northern white-cedar	333.8	91.2	165.2	77.4	--
Tamarack	40.3	--	19.9	16.0	4.4
Oak-hickory	1,296.1	290.1	719.7	242.2	44.1
Elm-ash-cottonwood	630.5	187.5	255.3	161.6	26.1
Maple-beech-birch	1,313.4	327.9	765.1	198.6	21.8
Aspen-birch:					
Aspen	2,061.3	172.8	1,049.9	775.9	62.7
Paper birch	174.0	33.1	98.0	42.9	--
All types	6,994.0	1,220.3	3,568.6	2,036.3	168.8

SOUTHERN LOWER PENINSULA

White-red-jack pine:					
Jack pine	12.3	--	1.6	10.7	--
Red pine	36.5	14.2	16.6	5.7	--
White pine	17.6	6.0	--	11.6	--
Scotch pine	36.2	--	4.3	31.9	--
Spruce-fir:					
Balsam fir-white spruce	16.1	--	--	16.1	--
Northern white-cedar	10.1	--	4.6	--	5.5
Tamarack	20.5	5.9	--	8.5	6.1
Oak-hickory	1,016.5	432.3	237.1	259.4	87.7
Elm-ash-cottonwood	719.4	191.2	185.2	227.0	116.0
Maple-beech-birch	501.6	239.8	103.6	145.6	12.6
Aspen-birch:					
Aspen	405.7	10.6	126.8	246.7	21.6
Paper birch	23.7	3.9	--	7.2	12.6
All types	2,816.2	903.9	679.8	970.4	262.1

Table 18.—Area of commercial forest land, by forest type and stand-age class, Michigan, 1966
(In thousands of acres)

Forest type	All ages	Stand-age class (years)										
		0-19	20-39	40-49	50-59	60-69	70-79	80-89	90-99	100-119	120-139	140+
White-red-jack pine:												
Jack pine	896.7	232.6	402.7	156.2	69.5	29.8	--	5.6	0.3	--	--	--
Red pine	596.5	316.8	193.0	12.8	44.0	18.0	11.0	.9	--	--	--	--
White pine	154.3	45.4	7.2	20.5	10.1	18.1	14.6	9.3	5.3	16.5	3.9	3.4
Scotch pine	118.2	111.7	4.3	2.2	--	--	--	--	--	--	--	--
Spruce-fir:												
Balsam fir-white spruce	1,081.7	319.2	328.6	176.6	115.5	60.5	47.2	.3	16.9	16.9	--	--
Black spruce	428.1	63.9	140.1	39.4	78.4	22.8	56.5	26.4	.4	--	.2	--
Northern white-cedar	1,187.7	107.3	180.7	167.9	194.4	159.9	89.7	97.3	40.2	75.0	65.9	9.4
Tamarack	176.0	48.6	36.8	42.3	31.3	5.5	11.3	.2	--	--	--	--
Oak-hickory	2,405.0	562.2	425.4	320.1	377.6	205.7	171.9	119.0	35.8	145.7	41.6	--
Elm-ash-cottonwood	1,936.0	537.4	442.8	258.3	227.6	106.1	92.7	67.6	48.4	86.3	33.4	35.4
Maple-beech-birch	5,244.5	597.8	1,059.8	754.9	709.1	386.2	344.1	253.9	203.5	409.1	340.0	186.1
Aspen-birch:												
Aspen	4,259.0	1,579.9	1,603.5	630.2	249.9	113.8	60.9	15.3	5.5	--	--	--
Paper birch	416.5	90.9	156.8	85.7	65.7	5.1	.4	8.4	--	3.5	--	--
All types	18,900.2	4,613.7	4,981.7	2,667.1	2,173.1	1,131.5	900.3	604.2	356.3	753.0	485.0	234.3

Table 19.—Area of commercial forest land, by forest type and area-condition class, Michigan, 1966
(In thousands of acres)

Forest type	All area conditions	Excellent	Good	Favorable	Moderately favorable	Fair	Unfavorable
White-red-jack-pine:							
Jack pine	896.7	1.6	1.2	.3	394.8	347.2	151.6
Red pine	596.5	.6	32.2	9.0	211.4	227.4	115.9
White pine	154.3	.6	.5	--	51.4	65.9	35.9
Scotch pine	118.2	--	6.4	7.0	27.7	54.2	22.9
Spruce-fir:							
Balsam fir-white spruce	1,081.7	3.9	47.0	17.0	604.4	326.3	83.1
Black spruce	428.1	1.4	3.2	.8	237.8	136.3	48.6
Northern white-cedar	1,187.7	20.4	.3	42.2	795.6	203.5	125.7
Tamarack	176.0	.3	.4	--	45.3	55.4	74.6
Oak-hickory	2,405.0	.1	17.7	227.2	732.1	786.2	641.7
Elm-ash-cottonwood	1,936.0	1.8	6.1	133.1	698.9	527.4	568.7
Maple-beech-birch	5,244.5	47.2	25.2	554.4	2,915.5	1,310.5	391.7
Aspen-birch:							
Aspen	4,259.0	83.2	38.3	336.0	1,473.7	1,372.6	955.2
Paper birch	416.5	1.6	8.4	21.8	115.2	162.3	107.2
All types	18,900.2	162.7	186.9	1,348.8	8,303.8	5,575.2	3,322.8

Table 20.—Area of commercial forest land, by forest type and site-index class, Michigan, 1966
(In thousands of acres)

Forest type	All sites	Site index class (height in feet at 50 years)								
		10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
White-red-jack pine:										
Jack pine	896.7	--	6.0	33.5	441.3	288.3	122.7	4.9	--	--
Red pine	596.5	--	--	10.6	91.7	190.4	175.7	119.6	8.5	--
White pine	154.3	--	--	8.7	19.7	67.0	53.2	5.7	--	--
Scotch pine	118.2	--	--	--	2.2	31.0	58.3	10.2	16.5	--
Spruce-fir:										
Balsam fir-white spruce	1,081.7	--	.1	105.4	315.7	448.1	159.0	48.4	5.0	--
Black spruce	428.1	--	109.7	206.6	61.8	49.8	.2	--	--	--
Northern white-cedar	1,187.7	51.4	394.4	439.0	180.7	84.3	14.1	23.8	--	--
Tamarack	176.0	--	37.4	56.7	45.4	33.1	3.4	--	--	--
Oak-hickory	2,405.0	--	--	82.4	448.9	672.2	615.1	452.0	123.5	10.9
Elm-ash-cottonwood	1,936.0	--	--	61.0	298.7	517.5	563.6	275.0	179.5	40.7
Maple-beech-birch	5,244.5	--	18.2	101.5	886.1	2,230.1	1,354.3	431.0	159.3	64.0
Aspen-birch:										
Aspen	4,259.0	--	--	65.2	340.6	1,101.0	1,302.0	981.2	380.0	89.0
Paper birch	416.5	--	--	9.1	107.6	124.3	121.9	45.4	8.2	--
All types	18,900.2	51.4	565.8	1,179.7	3,240.4	5,837.1	4,543.5	2,397.2	880.5	204.6

Table 21.—Area of commercial forest land, by stocking class of growing-stock trees and stand-size class, Michigan, 1966
(In thousands of acres)

Stocking percentage	All stands	Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked areas
70 or more	9,557.9	2,871.0	4,941.3	1,745.6	--
40 to 70	5,760.0	1,310.1	2,345.1	2,104.8	--
10 to 40	3,043.9	542.1	919.4	1,582.4	--
Less than 10	538.4	--	--	--	538.4
All classes	18,900.2	4,723.2	8,205.8	5,432.8	538.4

Table 22.—Number of growing-stock trees on commercial forest land, by species and diameter class, Michigan, 1966
(In thousands of trees)

Species	All classes	Diameter class (inches at breast height)											
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:													
White and red pines:													
White pine	26,592	7,924	5,046	3,439	3,582	2,442	1,581	1,127	724	297	378	52	--
Red pine	54,721	37,313	8,852	3,091	2,309	1,498	818	474	279	87	--	--	--
Jack pine	109,818	74,445	26,474	6,269	2,014	494	107	15	--	--	--	--	--
Spruce and balsam fir:													
White spruce	41,155	21,136	11,717	4,167	2,236	1,154	467	174	66	31	7	--	--
Black spruce	68,116	49,148	14,917	2,947	727	208	122	47	--	--	--	--	--
Balsam fir	190,342	130,297	43,722	11,787	3,464	797	210	50	15	--	--	--	--
Hemlock	51,032	14,021	10,193	8,812	7,113	4,805	2,853	1,343	923	441	492	36	--
Other softwoods:													
Tamarack	18,878	13,244	4,070	924	381	183	37	39	--	--	--	--	--
Northern white-cedar	236,380	136,985	61,193	21,775	9,225	3,949	1,684	806	378	205	172	8	--
Others	1,132	591	341	84	116	--	--	--	--	--	--	--	--
Total softwoods	798,166	485,104	186,525	63,295	31,167	15,530	7,879	4,075	2,385	1,061	1,049	96	--
Hardwoods:													
Select white oaks	60,740	26,388	15,765	8,460	4,143	2,592	1,538	828	488	167	302	69	--
Select red oaks	85,040	33,639	22,617	13,151	6,959	3,689	2,138	1,043	811	513	418	62	--
Other red oaks	53,280	22,190	13,564	8,122	4,751	2,135	1,422	514	283	205	89	5	--
Hickory	10,447	3,761	2,682	2,214	763	556	257	71	95	40	8	--	--
Yellow birch	53,434	21,581	10,265	7,802	4,896	3,690	2,458	1,203	751	348	362	78	--
Hard maple	306,199	162,734	66,455	32,500	17,903	11,833	7,215	4,266	1,763	785	688	57	--
Soft maple	202,645	109,537	47,888	22,687	10,783	6,528	2,629	1,322	600	306	305	58	2
Beech	36,645	13,578	7,413	4,894	3,726	2,608	2,196	1,239	521	308	159	3	--
Ash	84,831	45,461	23,041	9,052	4,087	1,585	1,029	317	104	67	85	3	--
Cottonwood and aspen:													
Balsam poplar	25,237	9,985	5,458	4,503	2,488	1,387	742	386	177	58	53	--	--
Cottonwood	3,194	337	540	285	871	411	306	225	116	40	55	8	--
Bigtooth aspen	149,758	75,906	42,101	20,313	7,354	2,987	854	125	111	--	--	7	--
Quaking aspen	233,679	116,860	72,458	28,073	10,760	4,158	1,096	189	47	29	9	--	--
Basswood	61,181	25,930	17,722	8,912	4,692	2,293	920	308	218	125	61	--	--
Yellow poplar	449	190	78	46	30	20	44	11	--	8	22	--	--
Black walnut	120	--	--	--	49	35	16	--	10	10	--	--	--
Other hardwoods:													
Black cherry	27,418	14,346	7,308	3,393	1,367	513	309	141	18	19	--	4	--
Elm	87,768	35,666	22,067	13,670	7,758	3,997	1,895	1,283	604	371	380	71	6
Paper birch	122,677	69,743	32,647	12,723	5,133	1,560	712	116	12	25	6	--	--
Others	6,400	2,785	1,469	1,088	440	275	158	69	35	24	57	--	--
Noncommercial species	107	60	37	10	--	--	--	--	--	--	--	--	--
Total hardwoods	1,611,249	790,677	411,575	201,898	98,953	52,852	27,934	13,656	6,764	3,448	3,059	425	8
All species	2,409,415	1,275,781	598,100	265,193	130,120	68,382	35,813	17,731	9,149	4,509	4,108	521	8

Table 23.—Number of growing-stock trees on commercial forest land, by diameter class, softwoods and hardwoods, and Forest Survey Unit, Michigan, 1966
(In thousands of trees)

ALL UNITS

Species group	All classes	Diameter class (inches at breast height)													
		1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods	3,504,469	1,599,726	1,106,577	485,104	186,525	63,295	31,167	15,530	7,879	4,075	2,385	1,061	1,049	96	--
Hardwoods	6,687,338	3,450,331	1,625,758	790,677	411,575	201,898	98,953	52,852	27,934	13,656	6,764	3,448	3,059	425	8
All species	10,191,807	5,050,057	2,732,335	1,275,781	598,100	265,193	130,120	68,382	35,813	17,731	9,149	4,509	4,108	521	8
EASTERN UPPER PENINSULA															
Softwoods	1,489,940	695,960	485,520	193,437	70,997	22,321	11,084	5,314	2,639	1,360	645	415	231	17	--
Hardwoods	1,236,872	626,584	304,468	149,173	78,858	38,925	17,819	9,729	5,797	2,924	1,376	703	429	87	--
All species	2,726,812	1,322,544	789,988	342,610	149,855	61,246	28,903	15,043	8,436	4,284	2,021	1,118	660	104	--
WESTERN UPPER PENINSULA															
Softwoods	914,129	400,754	286,949	119,533	53,874	24,397	13,543	6,926	3,754	1,865	1,318	518	641	57	--
Hardwoods	2,525,054	1,452,193	608,346	242,370	110,100	52,584	26,847	16,492	8,507	3,989	1,783	889	857	91	6
All species	3,439,183	1,852,947	895,295	361,903	163,974	76,981	40,390	23,418	12,261	5,854	3,101	1,407	1,498	148	6
NORTHERN LOWER PENINSULA															
Softwoods	1,026,993	462,534	312,874	165,805	59,031	15,460	5,869	2,859	1,293	637	405	83	134	9	--
Hardwoods	2,191,486	955,740	570,844	329,569	179,180	84,799	39,582	17,144	8,104	3,586	1,673	732	498	35	--
All species	3,218,479	1,418,274	883,718	495,374	238,211	100,259	45,451	20,003	9,397	4,223	2,078	815	632	44	--
SOUTHERN LOWER PENINSULA															
Softwoods	73,407	40,478	21,234	6,329	2,623	1,117	671	431	193	213	17	45	43	13	--
Hardwoods	733,926	415,814	142,100	69,565	43,437	25,590	14,705	9,487	5,526	3,157	1,932	1,124	1,275	212	2
All species	807,333	456,292	163,334	75,894	46,060	26,707	15,376	9,918	5,719	3,370	1,949	1,169	1,318	225	2

Table 24.—Percentage of sawtimber trees on commercial forest land, by butt-log grade and species, Michigan, 1966

(In percent)

Species	Percent of trees by butt-log grade			
	Grade 1	Grade 2	Grade 3	Grade 4[1/]
Softwoods:				
White and red pine				
White pine	7	13	50	30
Red pine	2	7	86	5
Jack pine	--	--	100	--
Spruce and balsam fir:				
White spruce	2	6	92	--
Black spruce	--	9	91	--
Balsam fir	--	3	94	3
Hemlock	6	16	74	4
Other softwoods:				
Tamarack	--	--	94	6
Northern white-cedar	--	4	95	1
Others	--	--	-	100
Total softwoods	3	8	82	7
Hardwoods:				
Select white oaks	18	34	42	6
Select red oaks	21	35	40	4
Other red oaks	12	30	43	15
Yellow birch	31	35	33	1
Hard maple	22	37	40	1
Soft maple	17	37	45	1
Beech	27	34	37	2
Ash	17	49	31	3
Cottonwood and aspen:				
Balsam poplar	16	35	43	6
Cottonwood	42	53	5	--
Bigtooth aspen	13	34	52	1
Quaking aspen	6	42	50	2
Basswood	24	37	39	--
Other hardwoods:				
Black cherry	21	26	51	2
Elm	28	41	30	1
Paper birch	13	31	53	3
Others	23	30	47	--
Total hardwoods	21	37	40	2
All species	14	26	56	4

1/ Grade 4 logs for hardwoods correspond to tie and timber logs.

Table 25.—Net volume of timber on commercial forest land, by timber class and by softwoods and hardwoods, Michigan, 1966

(In million cubic feet)

Timber class	All species	Softwoods	Hardwoods
Sawtimber trees:			
Saw-log portion	5,586.0	1,579.9	4,006.1
Upper-stem portion	985.7	278.8	706.9
Total sawtimber	6,571.7	1,858.7	4,713.0
Poletimber trees	8,453.3	1,979.7	6,473.6
Total growing stock	15,025.0	3,838.4	11,186.6
Rough trees:			
Short-log trees	250.8	32.5	218.3
Other rough trees	679.0	75.5	603.5
Rotten trees	242.7	30.3	212.4
Salvable dead trees	57.3	19.3	38.0
All classes	16,254.8	3,996.0	12,258.8

Table 26.—Net volume of growing stock and sawtimber on commercial forest land, by ownership class and by softwoods and hardwoods, Michigan, 1966

Ownership class	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Million cubic feet			Million board feet[1/]		
National Forest	1,705.9	619.2	1,086.7	2,742.7	1,078.3	1,664.4
State Forest	2,883.0	832.3	2,050.7	6,457.5	2,110.5	4,347.0
Other public	297.6	71.1	226.5	777.7	240.8	536.9
Forest industry	2,145.9	680.6	1,465.3	6,375.6	2,209.7	4,165.9
Farmer and miscellaneous private	7,992.6	1,635.2	6,357.4	17,509.8	4,062.8	13,447.0
All ownerships	15,025.0	3,838.4	11,186.6	33,863.3	9,702.1	24,161.2

1/ International 1/4-inch rule.

Table 27.—Net volume of growing stock on commercial forest land, by species and diameter class, Michigan, 1966
(In million cubic feet)

Species	All diameters	Diameter class (inches at breast height)											
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:													
White and red pines:													
White pine	388.2	22.5	31.9	35.8	54.6	52.6	49.7	45.6	37.2	18.9	32.3	7.1	--
Red pine	252.0	73.0	37.1	26.5	31.0	28.6	20.6	16.4	14.0	4.8	--	--	--
Jack pine	369.4	159.2	120.7	51.6	26.8	8.1	2.5	.5	--	--	--	--	--
Spruce and balsam fir:													
White spruce	246.0	54.6	66.2	42.3	34.0	22.5	13.7	6.5	3.3	2.0	.9	--	--
Black spruce	271.1	134.9	83.8	30.1	12.3	4.4	3.7	1.9	--	--	--	--	--
Balsam fir	733.5	314.8	235.7	111.1	48.0	15.1	6.6	1.6	.6	--	--	--	--
Hemlock	566.7	32.8	51.1	74.8	90.6	82.2	70.0	46.7	43.3	25.7	44.0	5.5	--
Other softwoods:													
Tamarack	84.0	37.3	26.4	9.2	5.1	3.5	1.1	1.4	--	--	--	--	--
Northern white-cedar	922.3	243.3	251.5	157.2	101.9	63.2	38.0	24.8	16.0	11.2	13.9	1.3	--
Others	5.2	1.4	1.5	.8	1.5	--	--	--	--	--	--	--	--
Total softwoods	3,838.4	1,073.8	905.9	539.4	405.8	280.2	205.9	145.4	114.4	62.6	91.1	13.9	--
Hardwoods:													
Select white oaks	400.5	44.9	63.6	65.8	51.6	48.0	37.6	27.5	19.8	9.2	23.5	9.0	--
Select red oaks	762.3	92.8	133.8	131.8	107.8	79.5	62.7	37.8	38.4	30.6	36.5	10.6	--
Other red oaks	394.0	53.4	69.3	72.4	65.1	44.6	38.3	18.6	14.2	10.9	6.4	.8	--
Hickory	101.5	11.3	17.7	24.4	13.1	14.3	8.4	3.0	5.5	3.2	.6	--	--
Yellow birch	447.8	37.1	45.2	63.4	58.0	63.7	57.9	37.4	31.7	18.8	25.8	8.8	--
Hard maple	2,234.5	431.3	392.5	332.4	274.4	255.5	201.0	155.8	81.9	46.4	56.9	6.4	--
Soft maple	1,222.2	257.7	256.7	210.8	158.8	137.1	71.5	50.5	27.5	17.9	25.1	8.3	.3
Beech	422.3	37.7	44.4	52.2	58.3	58.1	64.0	49.5	25.6	18.9	13.2	.4	--
Ash	559.0	144.3	148.7	101.1	67.1	35.6	30.9	13.1	5.2	4.0	8.6	.4	--
Cottonwood and aspen:													
Balsam poplar	232.2	26.9	32.7	47.1	40.7	29.3	24.7	15.1	8.5	3.3	3.9	--	--
Cottonwood	76.7	1.6	3.5	3.8	17.1	11.2	11.8	11.1	7.1	3.3	5.0	1.2	--
Bigtooth aspen	771.2	190.6	213.8	177.4	100.4	57.5	21.4	4.4	4.8	--	--	.9	--
Quaking aspen	1,485.9	374.1	480.5	314.8	178.0	95.2	30.9	7.8	2.0	1.9	.7	--	--
Basswood	480.1	76.1	116.2	95.4	76.4	51.8	28.7	12.3	10.2	7.7	5.3	--	--
Yellow poplar	7.7	.9	.6	.5	.6	.5	1.4	.5	--	.6	2.1	--	--
Black walnut	3.1	--	--	--	.7	.8	.6	--	.5	.5	--	--	--
Other hardwoods:													
Black cherry	154.0	37.1	39.3	31.3	19.5	10.8	8.3	5.3	.9	1.0	--	.5	--
Elm	751.4	92.2	122.9	134.7	116.0	84.7	53.8	47.7	29.1	22.7	33.4	12.7	1.5
Paper birch	625.0	189.0	186.5	122.2	73.5	30.6	17.1	3.5	.6	1.4	.6	--	--
Others	55.2	6.2	7.1	12.0	6.3	5.2	8.1	2.5	1.4	1.4	5.0	--	--
Total hardwoods	11,186.6	2,105.2	2,375.0	1,993.5	1,483.4	1,114.0	779.1	503.4	314.9	203.7	252.6	60.0	1.8
All species	15,025.0	3,179.0	3,280.9	2,532.9	1,889.2	1,394.2	985.0	648.8	429.3	266.3	343.7	73.9	1.8

Table 28.—Net volume of sawtimber on commercial forest land, by species and diameter class, Michigan, 1966
(In million board feet)[1]

Species	All diameters	Diameter class (inches at breast height)									
		9.0- 2/: 10.9	11.0- 12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0- 20.9	21.0- 22.9	23.0- 28.9	29.0- 38.9	39.0+
Softwoods:											
White and red pines:											
White pine	2,120.9	210.6	324.3	314.3	315.6	297.6	238.4	129.5	239.6	51.0	--
Red pine	814.9	134.2	157.0	160.1	125.8	110.6	93.6	33.6	--	--	--
Jack pine	331.7	184.4	98.6	34.9	11.5	2.3	--	--	--	--	--
Spruce and balsam fir:											
White spruce	633.9	196.4	163.7	118.1	76.9	39.8	20.1	12.5	6.4	--	--
Black spruce	266.3	151.9	59.2	23.2	19.9	12.1	--	--	--	--	--
Balsam fir	779.3	464.4	200.9	68.3	33.4	8.8	3.5	--	--	--	--
Hemlock	2,793.8	371.6	476.1	447.9	415.5	290.7	281.1	174.5	296.0	40.4	--
Other softwoods:											
Tamarack	87.3	34.8	23.1	17.5	4.7	7.2	--	--	--	--	--
Northern white-cedar	1,860.3	584.6	402.9	284.3	190.9	138.5	92.7	69.8	86.7	9.9	--
Others	13.7	4.5	9.2	--	--	--	--	--	--	--	--
Total softwoods	9,702.1	2,337.4	1,915.0	1,468.6	1,194.2	907.6	729.4	419.9	628.7	101.3	--
Hardwoods:											
Select white oaks	1,029.0	--	216.0	215.0	175.2	129.1	93.7	44.2	113.4	42.4	--
Select red oaks	2,115.5	--	535.4	423.4	330.5	207.6	198.2	166.2	196.0	58.2	--
Other red oaks	978.7	--	296.4	221.6	194.5	96.0	78.3	54.4	33.3	4.2	--
Hickory	261.2	--	66.7	79.7	49.5	16.8	29.6	16.2	2.7	--	--
Yellow birch	1,473.0	--	217.8	279.9	283.5	195.6	170.0	109.8	161.2	55.2	--
Hard maple	5,830.1	--	1,335.7	1,325.2	1,096.3	903.0	486.4	290.7	350.7	42.1	--
Soft maple	2,382.4	--	690.8	668.5	348.8	263.9	150.9	92.4	127.5	37.9	1.7
Beech	1,571.7	--	280.7	304.0	350.1	290.4	148.6	114.4	82.1	1.4	--
Ash	840.0	--	333.0	174.7	162.2	71.9	27.7	20.3	47.8	2.4	--
Cottonwood and aspen:											
Balsam poplar	658.8	--	185.4	151.5	146.7	86.3	45.9	18.9	24.1	--	--
Cottonwood	366.5	--	86.8	59.4	66.5	61.6	40.0	18.4	27.8	6.0	--
Bigtooth aspen	1,036.7	--	548.0	311.8	118.2	23.9	29.0	--	--	5.8	--
Quaking aspen	1,647.3	--	903.3	506.0	170.3	43.7	10.0	10.4	3.6	--	--
Basswood	1,051.0	--	405.9	284.8	165.9	69.0	55.7	41.4	28.3	--	--
Yellow poplar	29.8	--	3.1	1.2	7.3	2.8	--	3.2	12.2	--	--
Black walnut	10.9	--	1.7	2.5	2.4	--	1.9	2.4	--	--	--
Other hardwoods:											
Black cherry	188.6	--	80.8	40.4	30.8	26.4	4.0	4.0	--	2.2	--
Elm	1,942.5	--	492.3	399.4	273.0	248.6	152.6	120.9	181.6	65.9	8.2
Paper birch	611.1	--	350.2	147.7	83.9	18.4	3.0	4.6	3.3	--	--
Others	136.4	--	27.1	25.0	30.6	12.2	7.6	7.9	26.0	--	--
Total hardwoods	24,161.2	--	7,057.1	5,621.7	4,086.2	2,767.2	1,733.1	1,140.7	1,421.6	323.7	9.9
All species	33,863.3	2,337.4	8,972.1	7,090.3	5,280.4	3,674.8	2,462.5	1,560.6	2,050.3	425.0	9.9

1/ International 1/4-inch rule.
2/ Softwoods only.

Table 29.—Net volume of growing stock on commercial forest land, by species and Forest Survey Unit, Michigan, 1966
(In million cubic feet)

Species	All Units	Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
Softwoods:					
White and red pines:					
White pine	388.2	119.0	136.7	94.0	38.5
Red pine	252.0	90.6	40.0	105.0	16.4
Jack pine	369.4	119.3	52.0	195.4	2.7
Spruce and balsam fir:					
White spruce	246.0	81.5	130.2	34.3	--
Black spruce	271.1	102.1	130.5	38.5	--
Balsam fir	733.5	246.3	309.8	177.4	--
Hemlock	566.7	158.1	308.2	91.8	8.6
Other softwoods:					
Tamarack	84.0	25.9	18.3	30.8	9.0
Northern white-cedar	922.3	330.5	224.6	360.5	6.7
Others	5.2	--	--	--	5.2
Total softwoods	3,838.4	1,273.3	1,350.3	1,127.7	87.1
Hardwoods:					
Select white oaks	400.5	.8	--	179.7	220.0
Select red oaks	762.3	18.3	87.3	446.3	210.4
Other red oaks	394.0	.8	--	238.6	154.6
Hickory	101.5	--	--	6.4	95.1
Yellow birch	447.8	122.7	276.4	41.8	6.9
Hard maple	2,234.5	522.5	1,105.9	490.6	115.5
Soft maple	1,222.2	284.3	296.7	377.2	264.0
Beech	422.3	208.3	.4	160.5	53.1
Ash	559.0	55.8	102.8	245.7	154.7
Cottonwood and aspen:					
Balsam poplar	232.2	95.1	20.8	110.1	6.2
Cottonwood	76.7	.4	--	31.1	45.2
Bigtooth aspen	771.2	68.2	76.2	562.0	64.8
Quaking aspen	1,485.9	275.4	564.8	567.0	78.7
Basswood	480.1	60.6	109.3	258.9	51.3
Yellow poplar	7.7	--	--	--	7.7
Black walnut	3.1	--	--	--	3.1
Other hardwoods:					
Black cherry	154.0	24.2	31.7	48.8	49.3
Elm	751.4	100.4	128.9	378.1	144.0
Paper birch	625.0	181.6	134.2	291.8	17.4
Others	55.2	2.1	6.7	10.5	35.9
Total hardwoods	11,186.6	2,021.5	2,942.1	4,445.1	1,777.9
All species	15,025.0	3,294.8	4,292.4	5,572.8	1,865.0

Table 30.—Net volume of sawtimber on commercial forest land, by species and Forest Survey Unit, Michigan, 1966
(In million board feet)[1]

Species	All Units	Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
Softwoods:					
White and red pines:					
White pine	2,120.9	665.4	738.3	494.1	223.1
Red pine	814.9	370.1	186.7	224.5	33.6
Jack pine	331.7	129.8	64.4	136.6	.9
Spruce and balsam fir:					
White spruce	633.9	168.6	386.9	78.4	--
Black spruce	266.3	71.9	173.9	20.5	--
Balsam fir	779.3	200.7	446.2	132.4	--
Hemlock	2,793.8	810.2	1,491.8	431.1	60.7
Other softwoods:					
Tamarack	87.3	34.3	20.7	19.4	12.9
Northern white-cedar	1,860.3	688.4	745.9	420.1	5.9
Others	13.7	--	--	--	13.7
Total softwoods	9,702.1	3,139.4	4,254.8	1,957.1	350.8
Hardwoods:					
Select white oaks	1,029.0	3.7	--	335.6	689.7
Select red oaks	2,115.5	40.7	189.2	1,107.8	777.8
Other red oaks	978.7	1.3	--	511.4	466.0
Hickory	261.2	--	--	32.9	228.3
Yellow birch	1,473.0	488.1	918.4	54.6	11.9
Hard maple	5,830.1	1,525.1	3,036.1	896.2	372.7
Soft maple	2,382.4	490.6	471.2	667.2	753.4
Beech	1,571.7	798.8	--	594.2	178.7
Ash	840.0	47.1	168.9	285.6	338.4
Cottonwood and aspen:					
Balsam poplar	658.8	246.8	36.9	353.4	21.7
Cottonwood	366.5	2.2	--	161.8	202.5
Bigtooth aspen	1,036.7	131.5	164.9	679.2	61.1
Quaking aspen	1,647.3	278.7	594.9	731.6	42.1
Basswood	1,051.0	125.1	199.7	549.1	177.1
Yellow poplar	29.8	--	--	--	29.8
Black walnut	10.9	--	--	--	10.9
Other hardwoods:					
Black cherry	188.6	20.7	24.6	74.3	69.0
Elm	1,942.5	217.2	322.7	1,025.5	377.1
Paper birch	611.1	185.8	157.7	262.3	5.3
Others	136.4	6.8	8.9	29.5	91.2
Total hardwoods	24,161.2	4,610.2	6,294.1	8,352.2	4,904.7
All species	33,863.3	7,749.6	10,548.9	10,309.3	5,255.5

1/ International 1/4-inch rule.

Table 31.—Net volume of growing stock and sawtimber on commercial forest land, by county and by softwoods and hardwoods, Michigan, 1966

County	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Million cubic feet			Million board feet[1/]		
Alcona	269.8	61.1	208.7	454.0	99.8	354.2
Alger	491.2	155.4	335.8	1,295.6	430.6	865.0
Allegan	85.8	5.5	80.3	245.7	23.5	222.2
Alpena	178.7	53.1	125.6	299.9	88.4	211.5
Antrim	145.2	23.9	121.3	284.8	43.5	241.3
Arenac	82.1	15.3	66.8	156.6	25.2	131.4
Baraga	527.0	164.0	363.0	1,439.9	546.0	893.9
Barry	64.1	2.7	61.4	187.7	11.0	176.7
Bay	35.1	6.0	29.1	69.3	11.6	57.7
Benzie	117.6	17.2	100.4	258.2	35.3	222.9
Berrien	48.2	1.9	46.3	144.6	8.3	136.3
Branch	38.3	1.5	36.8	113.3	6.3	107.0
Calhoun	66.6	2.4	64.2	178.8	9.3	169.5
Cass	53.4	2.4	51.0	150.5	10.7	139.8
Charlevoix	165.0	27.3	137.7	330.5	56.0	274.5
Cheboygan	262.8	64.6	198.2	468.1	109.1	359.0
Chippewa	565.2	226.4	338.8	1,283.6	525.3	758.3
Clare	195.8	29.7	166.1	380.1	59.7	320.4
Clinton	33.9	1.3	32.6	108.0	6.9	101.1
Crawford	197.3	49.2	148.1	319.5	64.5	255.0
Delta	457.2	181.9	275.3	973.9	417.7	556.2
Dickinson	371.7	142.2	229.5	873.1	457.9	415.2
Eaton	36.0	2.0	34.0	104.2	10.1	94.1
Emmet	183.8	32.2	151.6	381.5	64.5	317.0
Genesee	41.2	1.4	39.8	118.0	5.3	112.7
Gladwin	134.5	20.5	114.0	251.0	40.8	210.2
Gogebic	538.4	151.9	386.5	1,171.6	406.4	765.2
Grand Traverse	130.3	22.9	107.4	276.8	47.5	229.3
Gratiot	33.6	1.4	32.2	82.6	6.4	76.2
Hillsdale	48.5	1.5	47.0	148.3	7.3	141.0
Houghton	498.2	131.0	367.2	1,237.3	424.5	812.8
Huron	45.6	.9	44.7	109.2	2.8	106.4
Ingham	41.7	1.1	40.6	134.8	6.4	128.4
Ionia	41.1	3.0	38.1	123.8	15.0	108.8
Iosco	186.2	50.0	136.2	325.4	80.4	245.0
Iron	591.3	189.5	401.8	1,358.2	543.9	814.3
Isabella	80.1	11.9	68.2	165.2	24.8	140.4
Jackson	61.7	2.6	59.1	180.0	9.0	171.0
Kalamazoo	45.4	1.9	43.5	127.1	7.4	119.7
Kalkaska	205.8	55.8	150.0	371.5	92.4	279.1
Kent	82.1	4.3	77.8	229.7	18.8	210.9
Keweenaw	211.8	64.0	147.8	615.0	236.2	378.8
Lake	202.4	27.8	174.6	359.8	44.4	315.4
Lapeer	51.4	2.5	48.9	143.6	10.7	132.9
Leelanau	100.1	14.9	85.2	200.8	34.9	165.9

(Continued on next page)

Table 31 (continued)

County	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Million cubic feet			Million board feet[1/]		
Lenawee	41.3	1.5	39.8	123.1	6.5	116.6
Livingston	58.7	2.6	56.1	170.8	9.6	161.2
Luce	435.1	191.1	244.0	1,100.8	487.5	613.3
Mackinac	442.7	158.7	284.0	974.8	383.8	591.0
Macomb	35.1	1.3	33.8	103.8	5.5	98.3
Manistee	175.3	24.0	151.3	350.7	50.5	300.2
Marquette	939.9	360.8	579.1	2,525.5	1,185.8	1,339.7
Mason	117.1	16.8	100.3	237.0	35.9	201.1
Mecosta	110.6	14.8	95.8	225.3	33.5	191.8
Menominee	409.4	160.0	249.4	930.8	398.6	532.2
Midland	121.0	18.7	102.3	217.8	37.2	180.6
Missaukee	203.8	42.6	161.2	381.7	82.9	298.8
Monroe	23.1	.5	22.6	67.6	1.8	65.8
Montcalm	92.7	5.2	87.5	245.1	18.0	227.1
Montmorency	239.0	57.8	181.2	412.2	92.8	319.4
Muskegon	124.0	7.2	116.8	339.3	24.2	315.1
Newaygo	248.2	37.7	210.5	476.4	71.5	404.9
Oakland	83.7	3.7	80.0	234.3	13.0	221.3
Oceana	117.0	14.3	102.7	255.9	31.4	224.5
Ogemaw	180.0	33.5	146.5	318.5	55.6	262.9
Ontonagon	614.1	147.0	467.1	1,328.3	454.0	874.3
Osceola	138.8	18.9	119.9	278.5	41.3	237.2
Oscoda	226.5	70.1	156.4	365.4	87.9	277.5
Otsego	205.0	44.6	160.4	352.1	79.3	272.8
Ottawa	46.5	5.8	40.7	123.4	12.5	110.9
Presque Isle	238.3	64.2	174.1	415.4	99.1	316.3
Roscommon	203.9	55.5	148.4	342.8	82.4	260.4
Saginaw	70.2	2.8	67.4	190.2	12.7	177.5
St. Clair	52.9	2.9	50.0	147.2	12.8	134.4
St. Joseph	39.7	1.2	38.5	114.1	4.7	109.4
Sanilac	39.6	1.9	37.7	92.4	7.7	84.7
Schoolcraft	494.0	199.7	294.3	1,190.1	495.9	694.2
Shiawassee	30.3	1.4	28.9	95.4	8.1	87.3
Tuscola	66.6	2.7	63.9	153.0	11.2	141.8
Van Buren	58.6	3.1	55.5	167.4	12.3	155.1
Washtenaw	57.2	2.0	55.2	178.7	9.7	169.0
Wayne	26.2	1.0	25.2	79.9	5.3	74.6
Wexford	175.7	30.8	144.9	326.5	53.1	273.4
State total	15,025.0	3,838.4	11,186.6	33,863.3	9,702.1	24,161.2

1/ International 1/4-inch rule.

Table 32.—Net annual growth and removals of growing stock and sawtimber on commercial forest land, by species, Michigan, 1965

Species	Growing stock		Sawtimber	
	Growth	Removals	Growth	Removals
	Thousand cubic feet		Thousand board feet[1/]	
Softwoods:				
White and red pines:				
White pine	13,299	2,229	86,540	14,521
Red pine	25,064	2,026	71,050	8,177
Jack pine	21,934	17,526	52,850	46,531
Spruce and balsam fir:				
Spruce	24,125	5,318	90,600	21,417
Balsam fir	30,022	6,492	86,380	23,133
Hemlock	7,912	8,914	52,270	53,252
Other softwoods:				
Tamarack	1,917	562	6,390	2,206
Northern white-cedar	34,937	6,894	72,210	11,306
Others	830	41	3,180	101
Total softwoods	160,040	50,002	521,470	180,644
Hardwoods:				
Select white oaks	14,996	4,088	52,070	18,693
Select red oaks	31,391	11,711	148,760	51,354
Other red oaks	16,901	3,288	68,040	12,666
Hickory	3,501	2/	11,940	2/
Yellow birch	7,813	6,421	23,950	38,203
Hard maple	108,187	22,923	326,650	129,077
Soft maple	65,324	8,589	154,660	37,987
Beech	10,359	4,108	55,170	21,834
Ash	20,143	2,782	50,530	11,811
Cottonwood and aspen:				
Balsam poplar	7,502	997	42,610	5,819
Cottonwood	2,811	1,172	16,080	6,797
Aspen	62,338	68,264	288,340	192,653
Basswood	21,199	3,207	90,720	18,510
Yellow poplar	384	2/	1,250	2/
Black walnut	108	371	450	2,333
Other hardwoods:				
Black cherry	7,671	2/	17,860	2/
Elm	6,770	10,535	40,300	62,420
Paper birch	29,135	4,168	69,240	14,399
Others	2,984	3,837	8,560	18,232
Total hardwoods	419,517	156,461	1,467,180	642,788
All species	579,557	206,463	1,988,650	823,432

1/ International 1/4-inch rule.
2/ Removals included in other hardwoods.

Table 33.—Net annual growth and removals of growing stock and sawtimber on commercial forest land, by ownership class and by softwoods and hardwoods, Michigan, 1965

GROWING STOCK

Ownership class	Growth			Removals		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Thousand cubic feet					
National Forest	85,323	34,961	50,362	24,354	10,181	14,173
State Forest	108,057	33,501	74,556	27,483	8,619	18,864
Other public	12,383	3,451	8,932	1,324	429	895
Forest industry	72,878	20,628	52,250	31,265	9,654	21,611
Farmer and miscellaneous private	300,916	67,499	233,417	122,037	21,119	100,918
All ownerships	579,557	160,040	419,517	206,463	50,002	156,461

SAWTIMBER

	Thousand board feet[1/]					
National Forest	169,800	55,170	114,630	81,073	32,045	49,028
State Forest	412,365	126,301	286,064	84,025	26,521	57,504
Other public	42,995	12,399	30,596	4,112	1,307	2,805
Forest industry	294,720	82,030	212,690	141,720	41,668	100,052
Farmer and miscellaneous private	1,068,770	245,570	823,200	512,502	79,103	433,399
All ownerships	1,988,650	521,470	1,467,180	823,432	180,644	642,788

1/ International 1/4-inch rule.

Table 34.—Net annual growth of growing stock on commercial forest land, by species and Forest Survey Unit, Michigan, 1965

(In thousand cubic feet)

Species	All Units	Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
Softwoods:					
White and red pines:					
White pine	13,299	3,308	4,416	3,762	1,813
Red pine	25,064	4,195	1,614	16,782	2,473
Jack pine	21,934	8,865	3,746	8,591	732
Spruce and balsam fir:					
White spruce	14,185	5,517	7,198	1,470	--
Black spruce	9,940	4,922	4,007	1,011	--
Balsam fir	30,022	11,989	12,747	5,286	--
Hemlock	7,912	1,807	4,074	1,888	143
Other softwoods:					
Tamarack	1,917	682	699	374	162
Northern white-cedar	34,937	14,117	4,303	16,403	114
Others	830	--	--	--	830
Total softwoods	160,040	55,402	42,804	55,567	6,267
Hardwoods:					
Select white oaks	14,996	25	--	6,191	8,780
Select red oaks	31,391	1,445	5,268	17,731	6,947
Other red oaks	16,901	70	--	11,121	5,710
Hickory	3,501	--	--	148	3,353
Yellow birch	7,813	1,244	4,965	1,244	360
Hard maple	108,187	24,060	54,964	25,762	3,401
Soft maple	65,324	13,659	17,483	23,338	10,844
Beech	10,359	5,857	17	2,586	1,899
Ash	20,143	1,663	1,907	8,779	7,794
Cottonwood and aspen:					
Balsam poplar	7,502	2,360	581	4,255	306
Cottonwood	2,811	7	--	695	2,109
Bigtooth aspen	28,137	3,725	3,911	17,441	3,060
Quaking aspen	34,201	5,932	17,072	6,018	5,179
Basswood	21,199	2,930	6,015	10,463	1,791
Yellow poplar	384	--	--	--	384
Black walnut	108	--	--	--	108
Other hardwoods:					
Black cherry	7,671	1,363	1,840	1,632	1/ 2,836
Elm	6,770	5,265	6,665	1,999	1/ -7,159
Paper birch	29,135	7,169	5,782	14,977	1,207
Others	2,984	15	587	158	2,224
Total hardwoods	419,517	76,789	127,057	154,538	61,133
All species	579,557	132,191	169,861	210,105	67,400

1/ Mortality exceeded net annual growth.

Table 35.—Net annual growth of sawtimber on commercial forest land, by species and Forest Survey Unit, Michigan, 1965

(In thousand board feet) [1]

Species	All Units	Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
Softwoods:					
White and red pines:					
White pine	86,540	24,910	30,630	25,560	5,440
Red pine	71,050	19,100	7,910	35,950	8,090
Jack pine	52,850	24,640	6,550	21,080	580
Spruce and balsam fir:					
White spruce	68,710	27,040	33,110	8,560	--
Black spruce	21,890	6,050	13,260	2,580	--
Balsam fir	86,380	31,810	31,940	22,630	--
Hemlock	52,270	9,880	22,630	19,190	570
Other softwoods:					
Tamarack	6,390	370	880	3,570	1,570
Northern white-cedar	72,210	26,490	10,800	34,660	260
Others	3,180	--	--	--	3,180
Total softwoods	521,470	170,290	157,710	173,780	19,690
Hardwoods:					
Select white oaks	52,070	140	--	23,760	28,170
Select red oaks	148,760	4,590	17,740	96,910	29,520
Other red oaks	68,040	100	--	45,950	21,990
Hickory	11,940	--	--	510	11,430
Yellow birch	23,950	5,180	14,070	4,210	490
Hard maple	326,650	82,370	163,320	65,380	15,580
Soft maple	154,660	26,680	26,780	62,880	38,320
Beech	55,170	33,800	--	13,930	7,440
Ash	50,530	780	2,780	23,920	23,050
Cottonwood and aspen:					
Balsam poplar	42,610	13,210	3,550	24,800	1,050
Cottonwood	16,080	60	--	5,460	10,560
Bigtooth aspen	112,440	11,470	11,000	80,110	9,860
Quaking aspen	175,900	36,040	69,110	60,780	9,970
Basswood	90,720	14,690	17,320	50,880	7,830
Yellow poplar	1,250	--	--	--	1,250
Black walnut	450	--	--	--	450
Other hardwoods:					
Black cherry	17,860	2,870	2,810	4,300	2/ 7,880
Elm	40,300	19,380	20,670	16,880	2/ -16,630
Paper birch	69,240	17,040	9,080	39,740	3,380
Others	8,560	2/ -70	890	960	6,780
Total hardwoods	1,467,180	268,330	359,120	621,360	218,370
All species	1,988,650	438,620	516,830	795,140	238,060

1/ International 1/4-inch rule.
2/ Mortality exceeded net annual growth.

Table 36.—Timber removals from growing stock on commercial forest land, by item and species group, Michigan, 1965

(In thousand cubic feet)

Item	All species	Softwoods		Hardwoods	
		Pine	Other softwoods	Aspen	Other hardwoods
Roundwood products:					
Saw logs	54,885	2,334	3,281	6,032	43,238
Veneer logs and bolts	3,061	36	--	49	2,976
Pulpwood	100,912	16,578	15,813	54,908	13,613
Piling	147	2	12	--	133
Poles	128	61	67	--	--
Mine timbers	936	1	770	--	165
Posts	5,432	10	5,301	5	116
Other	5,376	703	130	2,058	2,485
Fuelwood	4,957	5	22	628	4,302
All products	175,834	19,730	25,396	63,680	67,028
Logging residues	15,129	1,571	2,575	3,394	7,589
Other removals	15,500	480	250	1,190	13,580
All removals	206,463	21,781	28,221	68,264	88,197

Table 37.—Timber removals from live sawtimber on commercial forest land, by item and species group, Michigan, 1965

(In thousand board feet)[1]

Item	All species	Softwoods		Hardwoods	
		Pine	Other softwoods	Aspen	Other hardwoods
Roundwood products:					
Saw logs	368,472	15,949	22,154	35,409	294,960
Veneer logs and bolts	22,367	256	--	354	21,757
Pulpwood	292,449	44,513	69,401	138,114	40,421
Piling	905	8	63	--	834
Poles	511	234	277	--	--
Mine timbers	4,668	7	3,599	--	1,062
Posts	6,216	12	5,463	28	713
Other	26,533	2,276	419	10,721	13,117
Fuelwood	16,408	26	112	2,072	14,198
All products	738,529	63,281	101,488	186,698	387,062
Logging residues	45,803	4,031	9,237	5,152	27,383
Other removals	39,100	2,018	589	803	35,690
All removals	823,432	69,330	111,314	192,653	450,135

1/ International 1/4-inch rule.

Table 38.—Timber removals from growing stock on commercial forest land, by species and Forest Survey Unit, Michigan, 1965

(In thousand cubic feet)

Species	All Units	Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
Softwoods:					
White and red pines:					
White pine	2,229	554	1,125	194	356
Red pine	2,026	762	217	904	143
Jack pine	17,526	4,506	3,525	9,405	90
Spruce and balsam fir:					
Spruce	5,318	2,292	2,913	113	--
Balsam fir	6,492	3,765	2,489	238	--
Hemlock	8,914	2,084	6,667	86	77
Other softwoods:					
Tamarack	562	218	247	10	87
Northern white-cedar	6,894	4,624	1,142	1,061	67
Others	41	--	--	--	41
Total softwoods	50,002	18,805	18,325	12,011	861
Hardwoods:					
Select white oaks	4,088	2	--	482	3,604
Select red oaks	11,711	73	309	6,001	5,328
Other red oaks	3,288	2	--	979	2,307
Yellow birch	6,421	1,680	4,640	38	63
Hard maple	22,923	4,585	13,259	1,398	3,681
Soft maple	8,589	519	985	2,217	4,868
Beech	4,108	1,705	353	867	1,183
Ash	2,782	87	193	343	2,159
Cottonwood and aspen:					
Balsam poplar	997	857	43	38	59
Cottonwood	1,172	--	--	122	1,050
Aspen	68,264	11,697	18,388	35,410	2,769
Basswood	3,207	188	674	932	1,413
Black walnut	371	--	--	--	371
Other hardwoods:					
Elm	10,535	342	816	2,845	6,532
Paper birch	4,168	925	383	2,696	164
Others	3,837	139	695	527	2,476
Total hardwoods	156,461	22,801	40,738	54,895	38,027
All species	206,463	41,606	59,063	66,906	38,888

Table 39.—Timber removals from live sawtimber on commercial forest land, by species and Forest Survey Unit, Michigan, 1965

(In thousand board feet) [1]

Species	All Units	Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
Softwoods:					
White and red pines:					
White pine	14,521	3,732	7,595	1,293	1,901
Red pine	8,177	3,109	1,438	3,356	274
Jack pine	46,531	12,400	9,679	24,269	183
Spruce and balsam fir:					
Spruce	21,417	9,217	11,811	384	5
Balsam fir	23,133	13,654	8,592	885	2
Hemlock	53,252	13,083	39,092	573	504
Other softwoods:					
Tamarack	2,206	935	1,112	55	104
Northern white-cedar	11,306	6,895	2,826	1,532	53
Others	101	--	--	--	101
Total softwoods	180,644	63,025	82,145	32,347	3,127
Hardwoods:					
Select white oaks	18,693	20	--	2,764	15,909
Select red oaks	51,354	432	1,936	20,980	28,006
Other red oaks	12,666	5	--	3,976	8,685
Yellow birch	38,203	10,092	27,734	267	110
Hard maple	129,077	27,283	74,601	7,941	19,252
Soft maple	37,987	2,987	5,643	6,932	22,425
Beech	21,834	10,673	--	5,210	5,951
Ash	11,811	483	1,098	2,168	8,062
Cottonwood and aspen:					
Balsam poplar	5,819	5,072	251	279	217
Cottonwood	6,797	--	--	813	5,984
Aspen	192,653	27,787	48,728	110,281	5,857
Basswood	18,510	1,144	4,078	5,385	7,903
Black walnut	2,333	--	--	--	2,333
Other hardwoods:					
Elm	62,420	1,920	4,853	18,207	37,440
Paper birch	14,399	4,886	1,831	7,578	104
Others	18,232	811	6,110	3,435	7,876
Total hardwoods	642,788	93,595	176,863	196,216	176,114
All species	823,432	156,620	259,008	228,563	179,241

1/ International 1/4-inch rule.

Table 40.—Mortality [1] of growing stock and sawtimber on commercial forest land, by species, Michigan, 1966

Species	Growing stock	Sawtimber
	Thousand cubic feet	Thousand board feet 2/
Softwoods:		
White and red pines:		
White pine	2,729	10,519
Red pine	452	999
Jack pine	6,211	4,708
Spruce and balsam fir:		
White spruce	4,173	11,902
Black spruce	6,043	4,314
Balsam fir	25,737	27,893
Hemlock	6,291	32,332
Other softwoods:		
Tamarack	2,172	1,258
Northern white-cedar	7,359	22,153
Others	3	--
Total softwoods	61,170	116,078
Hardwoods:		
Select white oaks	3,112	6,245
Select red oaks	3,606	17,739
Other red oaks	1,851	5,427
Hickory	911	5,257
Yellow birch	4,460	13,103
Hard maple	7,255	27,262
Soft maple	6,349	15,662
Beech	3,854	18,719
Ash	8,845	19,960
Cottonwood and aspen:		
Balsam poplar	4,369	9,817
Cottonwood	859	2,336
Bigtooth aspen	22,288	55,915
Quaking aspen	78,640	118,521
Basswood	3,517	15,330
Other hardwoods:		
Black cherry	1,097	996
Elm	23,972	78,646
Paper birch	7,467	8,089
Others	231	563
Total hardwoods	182,683	419,587
All species	243,853	535,665

1/ Trend level: not for a specific year.
2/ International 1/4-inch rule.

Table 41.—Mortality [1] of growing stock and sawtimber on commercial forest land, by ownership class and by softwoods and hardwoods, Michigan, 1966

Ownership class	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Thousand cubic feet			Million board feet [2]		
National Forest	27,555	9,396	18,159	40,419	11,677	28,742
State Forest	46,760	13,267	33,493	101,104	25,364	75,740
Other public	4,833	1,132	3,701	12,242	2,890	9,352
Forest industry	34,758	10,845	23,913	99,136	26,547	72,589
Farmer and miscellaneous private	129,947	26,530	103,417	282,764	49,600	233,164
All ownerships	243,853	61,170	182,683	535,665	116,078	419,587

1/ Trend level - not for a specific year.
2/ International 1/4-inch rule.

Table 42.—Mortality [1] of growing stock and sawtimber on commercial forest land, by cause and by softwoods and hardwoods, Michigan, 1966

Cause	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Thousand cubic feet			Thousand board feet 2/		
Fire	--	--	--	--	--	--
Insects	31,327	3,270	28,057	76,496	--	76,496
Disease	113,784	20,715	93,069	277,380	48,551	228,829
Other	56,482	19,084	37,398	125,668	45,209	80,459
Unknown	42,260	18,101	24,159	56,121	22,318	33,803
All causes	243,853	61,170	182,683	535,665	116,078	419,587

1/ Trend level - not for a specific year.
2/ International 1/4-inch rule.

Table 43.—Output of timber products, by source of material and by softwoods and hardwoods, Michigan, 1965

Products and species group	Standard unit	Total output		Roundwood products		Plant byproducts	
		Number of std. units	Thousand cu. ft.	Number of std. units	Thousand cu. ft.	Number of std. units	Thousand cu. ft.
Saw logs:	M bd. ft.[1]						
Softwood		38,865	5,722	38,865	5,722	--	--
Hardwood		348,600	51,460	348,600	51,460	--	--
Total		387,465	57,182	387,465	57,182	--	--
Veneer logs and bolts:	M bd. ft.						
Softwood		256	36	256	36	--	--
Hardwood		22,111	3,025	22,111	3,025	--	--
Total		22,367	3,061	22,367	3,061	--	--
Pulpwood:	Std. cords[2]						
Softwood		434,095	34,284	428,880	33,872	5,215	412
Hardwood		931,040	73,523	885,255	69,906	45,785	3,617
Total		1,365,135	107,807	1,314,135	103,778	51,000	4,029
Piling:	M linear ft.						
Softwood		34	14	34	14	--	--
Hardwood		173	133	173	133	--	--
Total		207	147	207	147	--	--
Poles:	M pieces						
Softwood		15	128	15	128	--	--
Mine timbers (round):	M cu. ft.						
Softwood		1,057	1,057	1,057	1,057	--	--
Hardwood		165	165	165	165	--	--
Total		1,222	1,222	1,222	1,222	--	--
Posts (round and split):	M pieces						
Softwood		5,691	5,834	5,691	5,834	--	--
Hardwood		79	121	79	121	--	--
Total		5,770	5,955	5,770	5,955	--	--
Other:[3]	M cu. ft.						
Softwood		833	833	833	833	--	--
Hardwood		5,947	5,947	5,947	5,947	--	--
Total		6,780	6,780	6,780	6,780	--	--
Industrial products:	M cu. ft.						
Softwood		47,908	47,908	47,496	47,496	412	412
Hardwood		134,374	134,374	130,757	130,757	3,617	3,617
Total		182,282	182,282	178,253	178,253	4,029	4,029
Fuelwood:	Std. cords						
Softwood		16,900	1,147	2,314	126	14,586	1,021
Hardwood		354,400	24,741	262,300	18,294	92,100	6,447
Total		371,300	25,888	264,614	18,420	106,686	7,468
All products:	M cu. ft.						
Softwood		49,055	49,055	47,622	47,622	1,433	1,433
Hardwood		159,115	159,115	149,051	149,051	10,064	10,064
Total		208,170	208,170	196,673	196,673	11,497	11,497

1/ M (meaning thousand) board feet by International 1/4-inch rule.
2/ Rough-wood basis (includes chips converted to equivalent standard 128-cubic-foot cord).
3/ Includes charcoal wood, excelsior bolts, particleboard bolts, and farm timber.

Table 44.—Output of roundwood products, by source and by softwoods and hardwoods, Michigan, 1965
(In thousand cubic feet)

Products and species group	All sources	Growing-stock trees 1/			Rough and rotten trees 1/	Salvable dead trees 1/	Other sources 2/
		Total	Saw-timber	Pole-timber			
Saw logs:							
Softwood	5,722	5,615	5,587	28	107	--	--
Hardwood	51,460	49,270	49,192	78	--	1,553	637
Total	57,182	54,885	54,779	106	107	1,553	637
Veneer logs and bolts:							
Softwood	36	36	36	--	--	--	--
Hardwood	3,025	3,025	3,025	--	--	--	--
Total	3,061	3,061	3,061	--	--	--	--
Pulpwood:							
Softwood	33,872	32,391	22,167	10,224	123	872	486
Hardwood	69,906	68,521	37,097	31,424	282	316	787
Total	103,778	100,912	59,264	41,648	405	1,188	1,273
Piling:							
Softwood	14	14	14	--	--	--	--
Hardwood	133	133	133	--	--	--	--
Total	147	147	147	--	--	--	--
Poles:							
Softwood	128	128	106	22	--	--	--
Hardwood	--	--	--	--	--	--	--
Total	128	128	106	22	--	--	--
Mine timbers (round):							
Softwood	1,057	771	676	95	17	268	1
Hardwood	165	165	165	--	--	--	--
Total	1,222	936	841	95	17	268	1
Posts (round and split):							
Softwood	5,834	5,311	1,416	3,895	68	--	455
Hardwood	121	121	121	--	--	--	--
Total	5,955	5,432	1,537	3,895	68	--	455
Other 3/							
Softwood	833	833	467	366	--	--	--
Hardwood	5,947	4,543	3,837	706	1,084	--	320
Total	6,780	5,376	4,304	1,072	1,084	--	320
Total industrial products:							
Softwood	47,496	45,099	30,469	14,630	315	1,140	942
Hardwood	130,757	125,778	93,570	32,208	1,366	1,869	1,744
Total	178,253	170,877	124,039	46,838	1,681	3,009	2,686
Fuelwood:							
Softwood	126	27	17	10	5	--	94
Hardwood	18,294	4,930	2,869	2,061	1,037	--	12,327
Total	18,420	4,957	2,886	2,071	1,042	--	12,421
All products:							
Softwood	47,622	45,126	30,486	14,640	320	1,140	1,036
Hardwood	149,051	130,708	96,439	34,269	2,403	1,869	14,071
Total	196,673	175,834	126,925	48,909	2,723	3,009	15,107

1/ On commercial forest land.

2/ Includes trees less than 5.0 inches in diameter, tree tops and limbs from commercial forest areas or material from noncommercial forest land or nonforest land such as fence rows or suburban areas.

3/ Includes charcoal wood, excelsior bolts, particleboard bolts, and farm timbers.

Table 45.—A comparison of the number of primary wood-using plants operating in 1954 and 1965, by Forest Survey Unit, Michigan
(In number of plants)

Kind of plant 1/	All units		Eastern Upper Peninsula		Western Upper Peninsula		Northern Lower Peninsula		Southern Lower Peninsula	
	1954	1965	1954	1965	1954	1965	1954	1965	1954	1965
Sawmills:										
Large 2/	11	15	1	2	10	8	--	1	--	4
Medium 3/	85	107	14	20	35	20	17	32	19	35
Small 4/	1,866	266	314	23	320	13	574	110	658	120
Total	1,962	388	329	45	365	41	591	143	677	159
Veneer mills:										
Face and core	4	4	2	2	1	--	1	1	--	1
Container	19	8	5	1	--	--	3	3	11	4
Total	23	12	7	3	1	--	4	4	11	5
Pulpmills	11	10	4	3	1	2	2	2	4	3
Charcoal plants	2	1	--	--	2	1	--	--	--	--
Misc. plants	102	5/ 26	20	10	15	3	41	12	26	1
Grand total	2,100	437	360	61	384	47	638	161	718	168

1/ Excludes idle mills except for small sawmills in 1954.
2/ Annual lumber output in excess of 5 million board feet.
3/ Annual lumber output from 1 million to 5 million board feet.
4/ Annual lumber output less than 1 million board feet.
5/ Includes 1 particleboard mill, 1 shingle mill, 1 specialty plant, 1 combination post and pole yard and fence plant, 2 wood-turning plants, 5 log cabin manufacturing plants, 5 wood-treating plants, and 10 fence plants.

Table 46.—Volume of unused residues at primary manufacturing plants, by industry, type of residue, and by softwoods and hardwoods, Michigan, 1965

(In thousand cubic feet)

Species and type of residue	All industries	Lumber	Veneer and plywood
Softwoods			
Coarse 1/	703	703	--
Fine 2/	381	381	--
Total	1,084	1,084	--
Hardwoods			
Coarse 1/	5,253	5,219	34
Fine 2/	4,551	4,498	53
Total	9,804	9,717	87
All species			
Coarse 1/	5,956	5,922	34
Fine 2/	4,932	4,879	53
Total	10,888	10,801	87

1/ Includes slabs, edgings, and veneer cores.
2/ Includes sawdust and shavings.

Table 47.—Value of timber products to producer, by Forest Survey Unit, Michigan, 1965 [1]

(In thousand dollars)

Survey Unit	All products	Product		
		Pulpwood	Lumber logs	All others
Eastern Upper Peninsula	11,240	6,080	2,945	2,215
Western Upper Peninsula	16,535	8,445	5,700	2,390
Northern Lower Peninsula	14,850	8,940	4,155	1,755
Southern Lower Peninsula	8,295	270	6,265	1,760
All units	50,920	23,735	19,065	8,120

1/ Value delivered to the mill.

Table 48.—Annual allowable cut of growing stock on commercial forest land, by species and Forest Survey Unit, Michigan, 1966 to 1975

(In thousand cubic feet)

Species	All Units	Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
Softwoods:					
White and red pines:					
White pine	10,220	3,491	4,065	2,424	240
Red pine	3,746	1,251	683	1,804	8
Jack pine	11,934	3,845	1,288	6,784	17
Spruce and balsam fir:					
White spruce	8,483	3,050	3,972	1,461	--
Black spruce	6,930	3,076	2,839	1,015	--
Balsam fir	32,134	11,130	12,113	8,891	--
Hemlock	16,043	4,670	8,072	2,637	664
Other softwoods:					
Tamarack	1,642	687	425	452	78
Northern white-cedar	36,485	16,053	9,421	10,834	177
Total softwoods	127,617	47,253	42,878	36,302	1,184
Hardwoods:					
Select white oaks	5,518	47	--	1,437	4,034
Select red oaks	12,234	204	2,318	5,632	4,080
Other red oaks	4,750	68	--	1,488	3,194
Hickory	2,545	--	--	110	2,435
Yellow birch	10,081	3,240	6,085	704	52
Hard maple	38,793	11,128	18,543	7,867	1,255
Soft maple	22,572	8,409	7,559	4,434	2,170
Beech	8,308	4,857	8	3,155	288
Ash	9,238	1,357	3,684	3,296	901
Cottonwood and aspen:					
Balsam poplar	10,677	4,695	460	5,476	46
Cottonwood	2,646	9	--	522	2,115
Bigtooth aspen	25,745	3,601	3,251	17,371	1,522
Quaking aspen	57,201	14,222	20,612	21,714	653
Basswood	7,525	1,415	1,997	3,490	623
Yellow poplar	65	--	--	--	65
Black walnut	29	--	--	--	29
Other hardwoods:					
Black cherry	1,986	435	423	480	648
Elm	12,751	2,432	4,009	5,092	1,218
Paper birch	18,938	5,623	5,025	8,094	196
Others	737	34	50	281	372
Total hardwoods	252,339	61,776	74,024	90,643	25,896
All species	379,956	109,029	116,902	126,945	27,080

Table 49.—Annual allowable cut of live sawtimber on commercial forest land, by species and Forest Survey Unit, Michigan, 1966 to 1975

(In thousand board feet)[1]

Species	All Units	Eastern Upper Peninsula	Western Upper Peninsula	Northern Upper Peninsula	Southern Upper Peninsula
Softwoods:					
White and red pines:					
White pine	60,492	21,309	24,056	13,766	1,361
Red pine	11,207	4,763	3,403	3,041	--
Jack pine	13,851	5,912	2,890	5,049	--
Spruce and balsam fir:					
White spruce	22,848	5,884	13,070	3,894	--
Black spruce	8,589	3,561	4,112	916	--
Balsam fir	41,172	10,247	22,557	8,368	--
Hemlock	85,611	24,270	40,249	16,166	4,926
Other softwoods:					
Tamarack	1,677	508	816	294	59
Northern white-cedar	100,537	42,765	38,768	18,805	199
Total softwoods	345,984	119,219	149,921	70,299	6,545
Hardwoods:					
Select white oaks	19,273	226	--	3,230	15,817
Select red oaks	36,313	678	5,367	12,378	17,890
Other red oaks	16,965	112	--	3,422	13,431
Hickory	7,561	--	--	540	7,021
Yellow birch	37,193	13,251	22,824	1,081	37
Hard maple	112,305	32,651	59,046	15,754	4,854
Soft maple	43,914	16,722	13,516	5,219	8,457
Beech	33,631	19,797	--	12,812	1,022
Ash	16,750	698	8,479	4,419	3,154
Cottonwood and aspen:					
Balsam poplar	27,489	15,070	661	11,758	--
Cottonwood	11,729	54	--	2,170	9,505
Bigtooth aspen	45,149	8,877	8,096	25,554	2,622
Quaking aspen	77,530	14,136	26,042	37,091	261
Basswood	17,021	2,888	4,326	7,079	2,728
Yellow poplar	282	--	--	--	282
Black walnut	134	--	--	--	134
Other hardwoods:					
Black cherry	2,630	301	306	754	1,269
Elm	35,666	6,027	14,411	11,281	3,947
Paper birch	20,056	5,579	6,902	7,200	375
Others	2,520	201	63	1,277	979
Total hardwoods	564,111	137,268	170,039	163,019	93,785
All species	910,095	256,487	319,960	233,318	100,330

1/ International 1/4-inch rule.

Table 50.—Removals,[1] net annual growth, and inventory of growing stock and sawtimber on commercial forest land, Michigan, 1966, and projection[2] to 1966

GROWING STOCK

Year	Removals			Growth			Inventory		
	All species	Soft-woods	Hard-woods	All species	Soft-woods	Hard-woods	All species	Soft-woods	Hard-woods
	(Million cubic feet)								
1966	206.5	50.0	156.5	579.5	160.0	419.5	15,025.0	3,838.4	11,186.6
1976	272.0	65.0	207.0	603.0	169.0	434.0	18,549.0	4,908.0	13,641.0
1986	343.0	80.0	263.0	639.0	185.0	454.0	21,684.0	5,953.0	15,731.0
1996	433.0	98.0	335.0	686.0	208.0	478.0	24,429.0	7,028.0	17,401.0
	SAWTIMBER								
	(Million board feet)[3]								
1966	823.4	180.6	642.8	1,988.7	521.5	1,467.2	33,863.3	9,702.1	24,161.2
1976	1,061.0	233.0	828.0	2,242.0	526.0	1,716.0	45,469.0	12,830.0	32,639.0
1986	1,291.0	289.0	1,002.0	2,365.0	530.0	1,835.0	56,744.0	15,500.0	41,244.0
1996	1,546.0	350.0	1,196.0	2,398.0	548.0	1,850.0	66,374.0	17,695.0	48,679.0

1/ Timber removals includes volumes "lost" due to land clearing, flooding, or reclassification of land use, in addition to timber cut and used.

2/ Based on the following assumptions: (a) that the area of commercial forest land will decline at a rate of 0.2 percent per year to about 16-1/2 million acres in 1996; (b) that the intensity of forest management practiced will increase slowly, but net growth rate will decline as stands fill in and the wave of ingrowth passes; (c) that wood will maintain its relative position in the national economy but the demand for timber products from Michigan will increase; and (d) that annual production of roundwood will increase until timber removals equal net growth--about 2,040. Further increases may be stimulated by intensive management and improved utilization. Adequate markets for northern white cedar must be developed before growth and removal curves for softwoods will close.

3/ International 1/4-inch rule.

Table 51.—Timber products output in Michigan, 1965, and projections to 1995

(In thousand cubic feet)

Year	Saw logs	Veneer logs	Miscellaneous 1/ industrial products	Pulpwood			Fuelwood		
				Total	Roundwood	Plant byproducts	Total	Roundwood	Plant byproducts
1965	57,182	3,061	14,232	107,807	103,778	4,029	25,888	18,420	7,468
1975	60,000	5,500	20,000	162,000	154,000	8,000	15,000	11,000	4,000
1985	65,000	7,500	25,000	222,000	206,000	16,000	13,000	10,000	3,000
1995	65,000	8,000	35,000	293,000	277,000	16,000	14,000	11,000	3,000

1/ Miscellaneous industrial products include particleboard bolts, poles, piling, mine timbers, posts, chemical wood, and box bolts.

Table 52.—Timber-based employment [1] in Michigan, 1965, and projections to 1995

(In number of man-years of employment) [2]

Year	Total	Forest management	Timber harvesting	Primary manufacture of timber products				
				Total	Sawmills and planing mills 3/	Veneer and plywood mills 3/	Pulp, paper and allied products mills 4/	Other
1965	19,350	3,200	5/6,850	9,300	3,500	1,100	4,000	700
1975	17,660	3,700	5,660	8,300	2,900	1,500	3,400	500
1985	16,050	4,400	5,050	6,600	2,300	1,300	2,600	400
1995	15,130	5,200	5,130	4,800	1,700	900	1,900	300

1/ Includes employment in forest management, timber harvesting and primary manufacturing plants and mills.

2/ A man-year is defined in this report as one man employed for 250 8-hour days.

3/ Sawmills, veneer mills, planing mills, and plywood mills attached to veneer mills (U.S. Census Bureau Standard Industrial Classification (SIC) codes 242, 2,432, and 2,443).

4/ Includes plants manufacturing pulp primarily from wood, and paper mills attached to pulpmills.

5/ Based on an assumption of 115 cubic feet of production per 8-hour man-day from stump to mill.

Table 53.—Timber-based payrolls [1] in Michigan, 1965, and projections to 1995

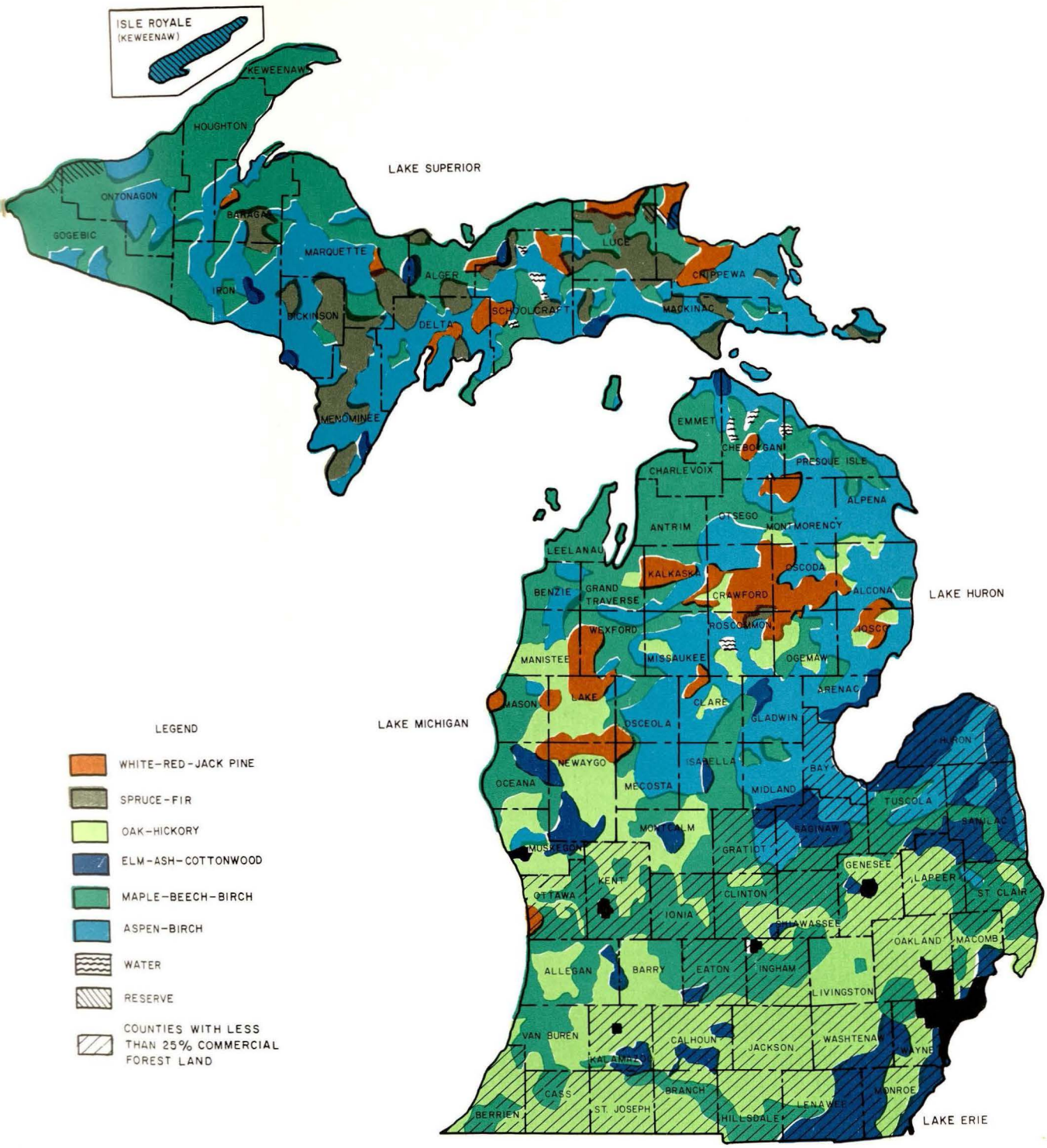
(In thousand dollars)

Year	Total	Forest management	Timber harvesting	Primary manufacture of timber products				
				Total	Sawmills and planing mills 2/	Veneer and plywood mills 2/	Pulp, paper and allied products mills 3/	Other
1965	95,200	19,200	25,200	50,800	14,100	5,800	27,100	3,800
1975	128,000	25,900	35,600	66,500	15,700	11,000	35,300	4,500
1985	162,700	37,400	47,700	77,600	16,700	13,900	41,900	5,100
1995	206,800	52,000	71,100	83,700	16,600	13,600	47,800	5,700

1/ Includes payrolls of persons engaged in forest management, timber harvesting, and primary manufacture of timber products.

2/ Sawmills, veneer mills, planing mills, and plywood mills attached to veneer mills (U.S. Census Bureau Standard Industrial Classification (SIC) codes 242, 2,432, and 2,443).

3/ Includes plants manufacturing pulp primarily from wood, and paper mills attached to pulpmills.



MAJOR FOREST TYPES—MICHIGAN

(1966)

PREVIOUS REPORTS ON MICHIGAN'S TIMBER RESOURCE

Forest Plantations of Northern Lower Michigan, by Robert N. Stone and Clarence D. Chase. U.S.D.A. Forest Serv. Sta. Paper No. 102, 30 p., illus. 1962.

Lake States Veneer Log Production Shows Increase in 1965, by Robert G. Knutson. U.S.D.A. Forest Serv. Res. Note NC-26, 3 p., illus. 1967.

Pulpwood Production and Consumption in the North Central Region by County, 1966, by James E. Blyth. U.S.D.A. Forest Serv. Resource Bull. NC-3, 27 p., illus. 1967.

Forest Area in Michigan Counties, 1966, by Arnold J. Ostrom. U.S.D.A. Forest Serv. Res. Note NC-38, 4 p., illus. 1967.

Forest Stand-Size Trends in Upper Michigan, 1955-1966, by Robert N. Stone. U.S.D.A. Forest Serv. Res. Note NC-39, 2 p., 1967.

Forest Cover Types by Counties, Michigan, 1966, by Arnold J. Ostrom. U.S.D.A. Forest Serv. Res. Note NC-41, 4 p., illus. 1967

Michigan's Timber Volume, by Clarence D. Chase. U.S.D.A. Forest Serv. Res. Note NC-50, 4 p., illus. 1968.

The Growing Timber Resource of Michigan, 1966, Eastern Upper Peninsula, by Clarence D. Chase and Ray E. Pfeifer. Michigan Department of Natural Resources, 66 p., illus. 1969.

ABOUT THE FOREST SERVICE . . .

As our Nation grows, people expect and need more from their forests — more wood; more water, fish, and wildlife; more recreation and natural beauty; more special forest products and forage. The Forest Service of the U.S. Department of Agriculture helps to fulfill these expectations and needs through three major activities:

- Conducting forest and range research at over 75 locations ranging from Puerto Rico to Alaska to Hawaii.
- Participating with all State forestry agencies in cooperative programs to protect, improve, and wisely use our Country's 395 million acres of State, local, and private forest lands.
- Managing and protecting the 187-million acre National Forest System.

The Forest Service does this by encouraging use of the new knowledge that research scientists develop; by setting an example in managing, under sustained yield, the National Forests and Grasslands for multiple use purposes; and by cooperating with all States and with private citizens in their efforts to achieve better management, protection, and use of forest resources.

Traditionally, Forest Service people have been active members of the communities and towns in which they live and work. They strive to secure for all, continuous benefits from the Country's forest resources.

For more than 60 years, the Forest Service has been serving the Nation as a leading natural resource conservation agency.